



VHF FM HANDY TRANSCEIVER

# C168/C168A

SERVICE MANUAL



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## Accessories

Flexible antenna, hand strap, belt clip, CMU160, \*CBT160, \*CNB161, \*CWC150A. (Accessories provided with the MODEL C168A include the CTN160 CNB161 and CWC150A.)

## Options

<p>CAW150 Mobile power supply cable</p> <p>CAX03 Bottom cover</p> <p>CAX160 Remote battery adaptor</p> <p>CBH160 Molded clip</p> <p>CBT160 Battery case (holds 5 size AA batteries)</p> <p>CCA160 Charger adaptor (CNB160/CNB161/CNB163)</p> <p>CHP111 Headset with PTT switch</p> <p>CHP150 Headset with VOX</p> <p>CLC160 Soft case (for use with CNB160 mounted)</p> <p>CLC161 Soft case (for use with CNB161/CBT160 mounted)</p> <p>CLC162 Soft case (for use with CNB162/CNB163 mounted)</p> <p>CMC151 Mobile charger (CNB160/CNB161/CNB163)</p> <p>CMB111 Mobile bracket</p>	<p>CMP111 Microphone and speaker</p> <p>CMP113 Tiepin microphone</p> <p>CMP115 Miniature microphone and speaker</p> <p>CMU160 Memory unit (4 kbit)</p> <p>CMU161 Memory unit (16 kbit)</p> <p>CNB160 Rechargeable battery pack (6 V, 300 mA)</p> <p>CNB161 Rechargeable battery pack (7.2 V, 700 mA)</p> <p>CNB162 Rechargeable battery pack (12 V, 600 mA)</p> <p>CNB163 Rechargeable battery pack (7.2 V, 1,000 mA)</p> <p>*CTN160 CTCSS (tone squelch) unit</p> <p>*CSA160 Desktop charger</p> <p>*CWC150 Wall charger (for CNB160/CNB161/CNB163)</p> <p>*CWC151K Wall charger (for CNB162)</p>
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\* Accessories provided with the MODEL C168A option include the CSA160A, CWC150A and CWC151A.

\* Accessories provided with the MODEL C168 option include the CSA160E, CWC150K and CWC151K.

# 1. CONTROLS AND CONNECTION

EXTERNAL MICROPHONE JACK

BELT CLIP

WATER PROOF

EXTERNAL SPEAKER JACK

SQUELCH CONTROL KNOB

ROTARY CHANNEL SELECTOR

CALL BUTTON

- TOP VIEW -

POWER ON/OFF SWITCH/VOLUME CONTROL KNOB

DISPLAY

FUNCTION BUTTON

LAMP BUTTON

PTT BUTTON

SQUELCH-OFF BUTTON

KEYBOARD

HAND STRAP

LOCK BUTTON

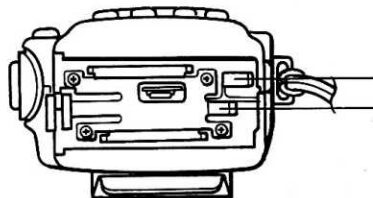
DC IN JACK

INTERNAL SPEAKER

INTERNAL MICROPHONE

BATTERY CASE/BATTERY PACK

- FRONT VIEW -



(+) POSITIVE POWER TERMINAL

(-) NEGATIVE POWER TERMINAL

- BOTTOM VIEW -

## 2. THEORY OF OPERATION

### 2.1 PLL Synthesizer

The strobe, clock and serial data signals from microprocessor Q248 are input to pins 11, 9 and 10, respectively, of PLL IC Q424. The frequency division ratio is determined by Q424.

The VCO frequency is applied to Q424 pin 8. The Q424's programmable frequency division ratio works as follows: the input frequency is divided by 1/N based on the frequency setting data, resulting in the reference frequency of 5 (6.25) kHz. The PLL circuit frequency is controlled by serial data from Q248.

The VCO circuit directly generates the transmission frequency (f0 MHz) and the reception frequency (f0-30.85 MHz).

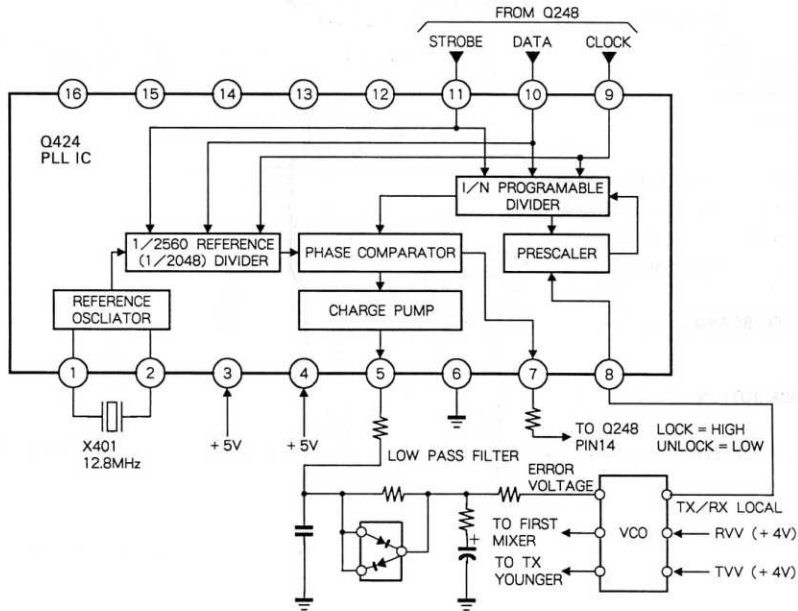


Figure 2-1 PLL Block Diagram

#### - Reference Frequency Circuit -

The reference frequency circuit generates the reference frequency of 5 (6.25) kHz. The reference generator frequency of 12.8 MHz is divided by the reference frequency divider stage in the PLL IC to produce this 5 (6.25) kHz reference frequency.

The reference frequency divider comprises a 16-bit shift register, a 15-bit latch register and a binary 14-bit reference counter. A reference frequency of either 5 or 6.25 kHz is generated based on the serial data received from microprocessor Q248. If the tuning step size is 5, 10, 20, 25, 50, 75 or 100 kHz, the microprocessor sends data causing a reference frequency of 5 kHz to be produced. If the tuning step size is 12.5 kHz, a reference frequency of 6.25 kHz is generated instead.

#### - Phase Comparator -

The phase comparator determines the phase shift between the frequency divided 5 (6.25) kHz reference frequency and the frequency divided by the programmable frequency divider.

If there is a difference in the phases, a low level output is produced from Q424 pin 7. If there is no phase difference, a high level signal is output from Q424 pin 7. The output from the phase comparator is also applied to the charge pump.

### – Low-pass Filter –

The low-pass filter (PLL loop filter) consists of a CR integrated circuit.

The pulse wave output from Q424 pin 5 is converted into a DC voltage by the low-pass filter. It is then applied to varactors Q551, Q552, Q564 and Q565 (reception VCO) or Q557 and Q558 (transmission VCO) in the VCO circuit block.

### – RX VCO Circuit –

The DC voltage from the low-pass filter is applied to varactors Q551, Q552, Q564 and Q565.

The DC voltage controls the frequency generated by the VCO by altering the capacitance between the poles of Q552 and Q553.

### – TX VCO Circuit –

The DC voltage from the low-pass filter is applied to varactors Q557 and Q558.

The DC voltage controls the frequency generated by the VCO by altering the capacitance between the poles of Q557 and Q558.

Frequency modulation is controlled by applying the modulation signal from the microphone amplifier to varactor Q559.

### – Unlock Detect Circuit –

Lock/unlock status detection is performed by pin 14 of microprocessor Q248. After the pulse voltage output from Q424 pin 7 is converted to a DC voltage by the CR integrator circuit composed of R454 and C474, it is applied to Q248 pin 14.

In lock status, a high level pulse voltage is output from Q424 pin 7, so a high level signal is applied to Q415 pin 7. On the other hand, for as long as unlock status continues, a low level pulse voltage is output from Q415 pin 7, and a low level signal is applied to Q248 pin 14.

### – PLL Local –

The RX VCO output is amplified by buffer amplifier Q555 and then input to the gate of first mixer Q413. The TX VCO output is amplified by buffer amplifier Q561 and then applied to Younger amplifier Q421.

## 2.2 Receiver

The reception method used is first IF 30.85 MHz (Lower)/second IF 455 kHz (Lower) double conversion super heterodyne. The reception frequency band covered is 144.000 MHz ~ 147.995 MHz.

### – Front End –

The reception signal from the antenna passes through the low-pass filter and antenna switching circuit, and is then applied to RF coil L405. The reception signal tuned in by L405 is amplified by RF amplifier Q408. It then passes through a low-pass filter (L406, L407) and is then applied to the gate of first mixer Q413.

### – First Mixer –

The reception signal amplified by RF amplifier Q408 (f<sub>0</sub>) and the PLL local signal (f<sub>0</sub>-30.85 MHz) are both applied to first mixer Q413.

Q413 produces both the sum of f<sub>0</sub> and f<sub>0</sub>-30.85 MHz and the difference between them. However, the 30.85 MHz difference alone is selected by the crystal filter circuit (F401), thereby eliminating signal elements at adjacent frequencies. The result is then applied to first IF amplifier Q419 as the first IF signal.

### – IF Amplifier –

After the first IF signal is amplified by Q419 it is applied to pin 20 of IC Q203.

This 30.85 MHz IF signal is mixed by the second mixer in Q203 with the 30.395 MHz second local filter, which is generated internally by Q203. The result is output via Q203 pin 4 as the second IF signal.

After adjacent frequency elements have been removed from the second IF signal by F201, it is applied to Q203 pin 6. It is then demodulated by the IF limiter amplifier and quadrature detector circuit in Q203 and output from Q203 pin 11 as the audio signal.

### – Squelch Circuit –

A low-pass filter (R212, C213) eliminates 455 kHz elements from the audio signal output via Q203 pin 11. Noise elements pass through the R216 squelch controller. The squelch line is set by adjusting R216. Next, the noise elements which have passed through the high-pass filter (R215, C210, C211) are applied to IC Q203 pin 13. After being amplified by Q203's internal noise amplifier, they are output from pin 14. After the noise elements have been further amplified by Q202, they are detected by Q201, producing a DC voltage which is applied to Q203 pin 15. This signal is then output via pin 16 as the squelch signal. The squelch signal from pin 16 is input to Q248 pin 30 and used for future operation control. If the signal applied to pin 15 is 0.7 V or higher pin 16 becomes low level and squelch operates.

On the other hand, if the signal applied to pin 15 is lower than 0.7 V, pin 16 becomes high level and squelch does not operate.

### – Signal Strength Meter (S Meter) –

The Q203 pin 12 audio signal passes through semi-fixed resistor R211 and is input to Q248 pin 17. It is then A/D converted and used to light LCDs to produce the signal strength meter display.

### – Audio Circuitry –

After the audio signal output from IC Q203 passes through the de-emphasis circuit (R213, R332, C223) it is amplified by audio preamp Q221.

The output from Q221 passes through muting circuit Q215 and is adjusted by audio volume semi-fixed resistor R237. It is then applied to audio power amplifier Q214. After amplification by Q214 the audio signal passes through external speaker jack J402 and drives internal speaker E101.

### – DTMF Decoder –

A part of the audio signal from Q203 pin 11 is applied to pin 2 of DTMF decoder Q103. The audio signal applied to this pin is decoded to produce a digital signal and is output to pins 12 ~ 15 (D0 ~ D3) of Q103.

## 2.3 Transmitter

### – Microphone Amplifier –

The sound of the user's voice is converted into an audio signal by the internal and external condenser microphones, and applied to microphone amplifier Q238. Q238 comprises a opamp stage which includes a pre-emphasis circuit, and a low-pass filter. The signal amplified by Q238 is level adjusted by semi-fixed resistor R288 and then applied to the VCO modulator circuit. The internal tone signal is a rectangular waveform output from Q248 pin 23. Following level adjustment by semi-fixed resistor R303 it is input to the low-pass filter in Q238.

### – Power Amplifier –

The transmission signal from the VCO is amplified by Younger amplifier Q421 and applied to pin 1 of RF power module Q422. After amplification by Q422, the transmission signal is output via pin 5 and passes through a low-pass filter, the antenna switch and a low-pass filter. After second and third order harmonics have been sufficiently attenuated, the signal is supplied to the antenna. The transmission output power level is adjusted by semi-fixed resistor R229 to 5.0 W in the high power setting, to 2.5 W by R230 in the medium power setting or to 0.35 W by R228 in the low power setting.

### – APC Circuit –

After passing through the low-pass filter, a part of the transmission signal output from Q422 is detected by diode Q423 and converted into a DC voltage. The detection voltage is applied to APC amplifier Q591 and controls the emitter current of Younger amplifier Q421. In this way the transmission output is maintained at a constant level. Also, thermal sensor circuit Q592 controls Q591 based on the amount by which the temperature rises, causing the transmission output level to drop.

### – DTMF Encoder –

The DTMF signal is output from pin 17 of DTMF encoder Q234. Next, it is level adjusted by semi-fixed resistor R281 and applied to the low-pass filter in Q238.

## 2.4 Power Supply Circuitry

Power supplied via the DC IN jack and the battery terminal is routed by the power switch into the following categories.

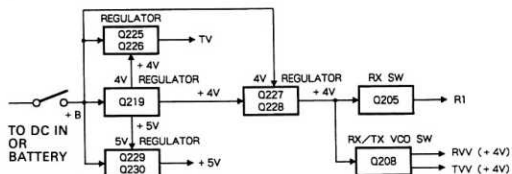


Figure 2-2

## 2.5 Control

### 2.5.1 Q248 Microprocessor

The microprocessor I/O port functions are as follows.

Table 2-1 I/O port functions

Pin no.	I/O	Symbol	Description
1	O	K3	} Keyboard data lines. Low: Q101 LCD driver BUSY signal detected.
2	O	K2	
3	O	K1	
4	O	K0	
5	O	CS	Low: Output of Q101 LCD driver chip select signal.
6	O	LSO	LCD driver (Q101) serial data output.
7	O	LCK	LCD driver (Q101) clock output.
8	O	OE	Output of DTMF decoder (Q103) enable signal. High: latched.
9	—	VSS	Ground.
10	I/O	D3	} Keyboard data lines. High: LCD driver (Q101) data input enabled.
11	I/O	D2	
12	I/O	D1	
13	I/O	D0	
14	I	UL	Unlock detect. Approx. 1.6 V or greater: PLL locked. Approx. 1.6 V or less: PLL unlocked.
15	I	BAT	Power supply voltage for lighting LCD mark detected. Lights when approx. 4.5 V.
16	I	SQLOFF	Low: Squelch off button depressed.
17	I	SM	Signal strength meter analogue signal input.
18	I	ED	High: Up signal indicating that rotary channel selector is being turned clockwise detected.
19	I	EU	High: Down signal indicating that rotary channel selector is being turned counterclockwise detected.
20	O	PD	High: DTMF decoder IC (Q103) power-down.
21	O	LAMP	Low: LCD backlight lights.
22	O	MONI	High: Audio power amplifier operating.
23	O	BST	Tone rectangular wave output.
24	I	CALL	Low: CALL button depressed.
25	O	SO	Serial data output to PLL and tone IC.
26	O	CK	Clock output to PLL and tone IC.
27	I	INT4	High: Transceiver operating. Low: Power ON/OFF detect when power is off.
28	—	—	—
29	I	PTT	High: PTT depressed.
30	I	SQL	Squelch input. High: Squelch off. Low: Squelch on.
31	I	FUNC	FUNC button. Low: FUNC button depressed.
32	—	—	—

**Table 2-1**

Pin no.	I/O	Symbol	Description
33	O	SQC	Squelch operation. Low: Squelch operating.
34	O	R1	Low: Receiving. High: Transmitting.
35	—	—	—
36	—	—	—
37	—	—	—
38	O	TVV	Transmitter VCO power supply.
39	O	TV	Low: Transmitting.
40	—	VDD	Microprocessor power supply pin. Approx. 4 V.
41	—	VDD	Microprocessor power supply pin. Approx. 4 V.
42	I	SQT	When tone squelch unit is installed. Low: squelch non-operational (tone frequency matches).
43	O	H	Low: Transmitting at high power.
44	O	M	Low: Transmitting at medium power.
45	O	POW	5 V power supply. Low: on.
46	O	TE	Tone data enable signal. High: latched.
47	O	RLED	High: RX LED lit.
48	O	PE	PLL data enable signal. High: latched.
49	O	MUTE	High: DTMF signal transmission with muting on.
50	O	COL3	} DTMF encoder (Q234) COL signal. Always low.
51	O	COL2	
52	O	COL1	
53	O	COL4	
54	—	RES	Low: Resets microprocessor.
55	—	X2	Ceramic oscillating element connection.
56	—	X1	Ceramic oscillating element connection.
57	I/O	RAD	EEPROM data line.
58	O	RCK	EEPROM clock line.
59	O	MTX	Diode matrix line.
60	I	DV	High: DTMF decoder active.
61	O	ROW1	} DTMF encoder (Q234) ROW signal. Always high.
62	O	ROW2	
63	O	ROW3	
64	O	ROW4	



### 2.5.2 Buzzer

DTMF encoder Q234 receives data from the microprocessor and outputs a single tone signal via pin 17. This signal passes through R281 and is applied to pin 2 of audio power amplifier Q214.

### 2.5.3 LCD Driver

LCD driver Q101 receives data from the microprocessor Q248 and drives LCD Q102.

### 2.5.4 Display

The display employs electrolytic effect type dynamically driven (1/3 duty ratio, 1/3 bias) LCD elements.

There are 31 segment pins and three common pins, and the third-order division technique results in a display duty ratio of 1/3. The numbers in parentheses ( ) in Figure 2-3 below indicate the Q101 LCD driver pin numbers.

## 2.6 Options

### 2.6.1 CTN160

(The CTN160 already installed on the MODEL C168A.)

#### - Decoder -

After passing through audio preamp Q221, a part of the audio signal from Q203 pin 11 is applied to pin 24 of tone IC Q801 via the AFT terminal.

When the preset tone frequency is detected within Q801, pin 13 (SQT) becomes low level, controlling microprocessor future operation.

#### - Encoder -

Q801 receives serial data from microprocessor Q248 and, based on this data, outputs the specified tone signal via pin 16. After level adjustment by semi-fixed resistor R805, the tone signal is input to the low-pass filter of microphone amplifier Q238 via the TON terminal.

### 2.6.2 CMU160/CMU161

(The MODEL C168/C168A comes with the CMU160 already installed.)

Control signals (or data) output from microprocessor Q248 are input to Q701 pin 9. Q701 determines whether data write or read is to take place based on the control signals received.

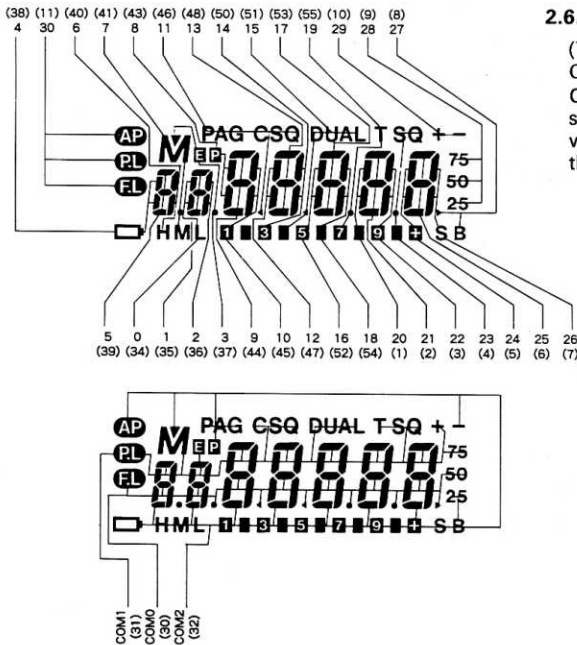
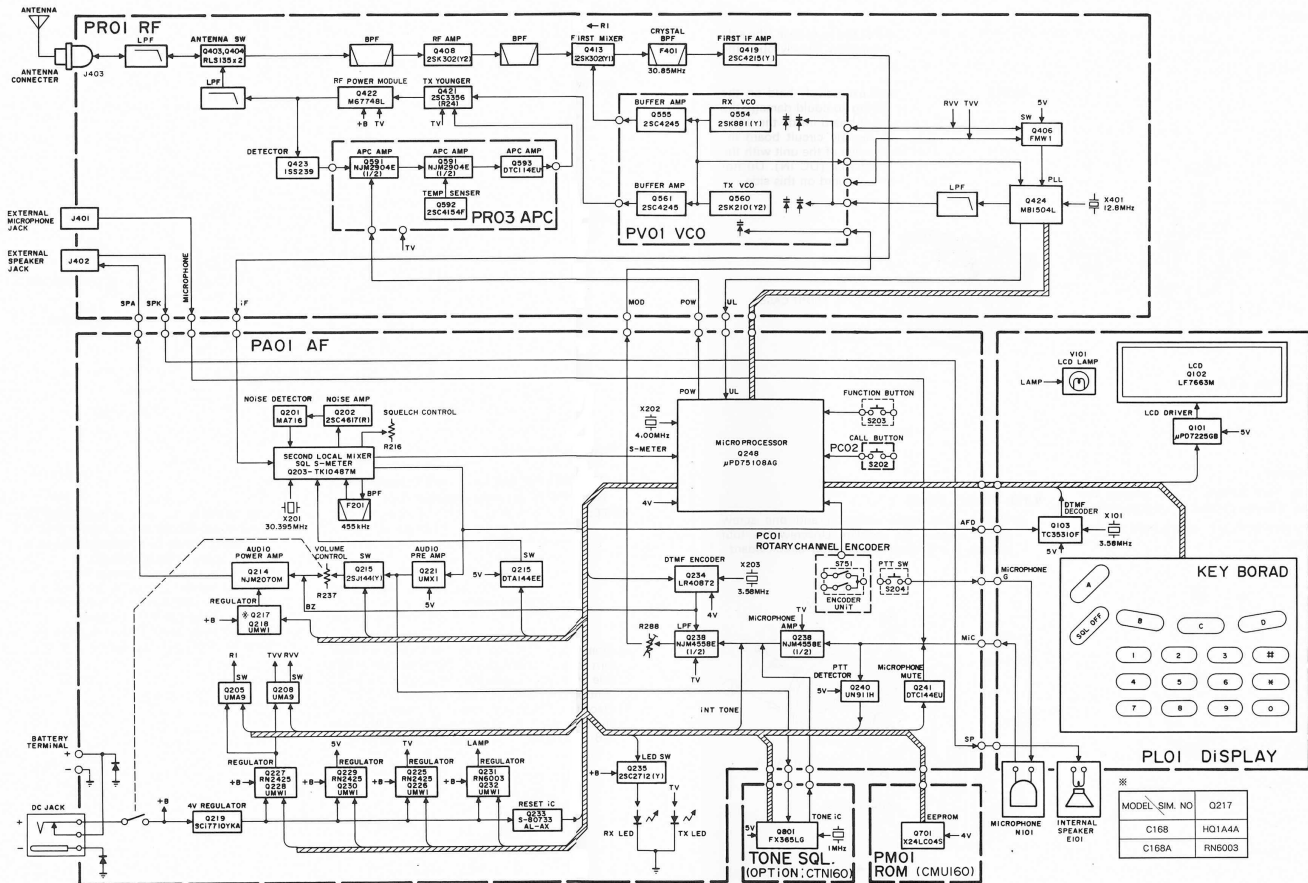


Figure 2-3 Segment Display

### 3. BLOCK DIAGRAM



## 4. MAINTENANCE

### 4.1 Disassembly Instructions

- a) Before removing any screws, switch the power off and remove the antenna, battery case and water proof cap (DC IN).

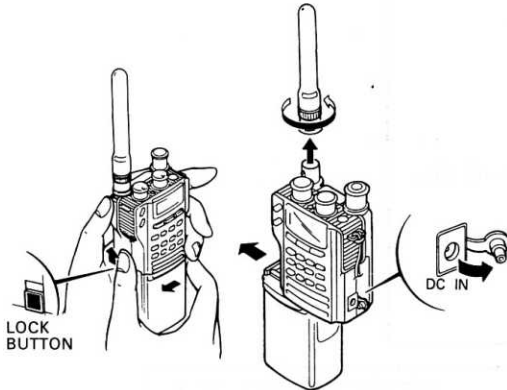


Figure 4-1

### 4.1.2 Front Case

- a) Turn the unit over so that the front case (the side with the display) is facing up. Slowly open the front case to the right.

- NOTE:**
1. Do not pull excessively hard on the left side. Doing so could damage the flexible circuit board inside the unit.
  2. There is a flexible circuit board located on the side of the unit with the external input jack (DC IN). Do not pull excessively hard on this side.

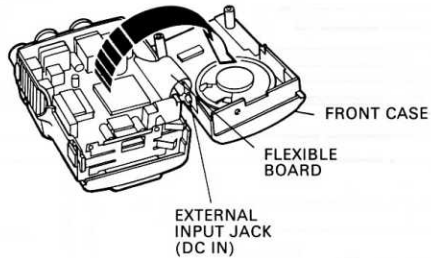


Figure 4-3

### 4.1.1 Bottom Cover

- a) Unscrew the two screws (A) and remove the bottom cover. Loosen the two screws (B) slightly.
- b) Unscrew the two screws (C) which hold the rear case in place.

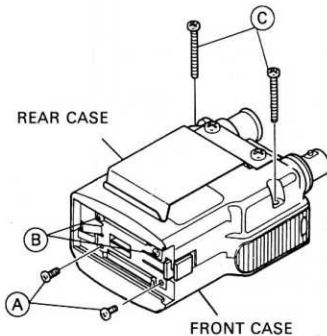


Figure 4-2

### 4.1.3 Display Board

- a) Unscrew the three screws (L) and one screw (M) and remove the speaker. Unscrew the four screws (N) and remove the display circuit board.

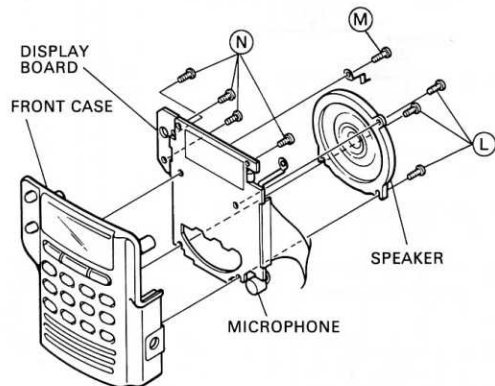


Figure 4-4

#### 4.1.4 AF/RF Board

- a) Unplug connectors (D), (E), (F) and unscrew the two screws. The AF board can now be removed.
- b) Remove the VOL and SQL control knobs and the two nuts. The escutcheon can now be removed.
- c) Remove the shield panel and unscrew the four screws (H), (I), (J) and (K). The RF and APC boards as well as Q422 can now be removed.
- d) Unscrew the antenna nut. The antenna connector and antenna jack can now be removed.
- e) Remove the channel knob and nut (O). The channel switch can now be removed from the rear case.

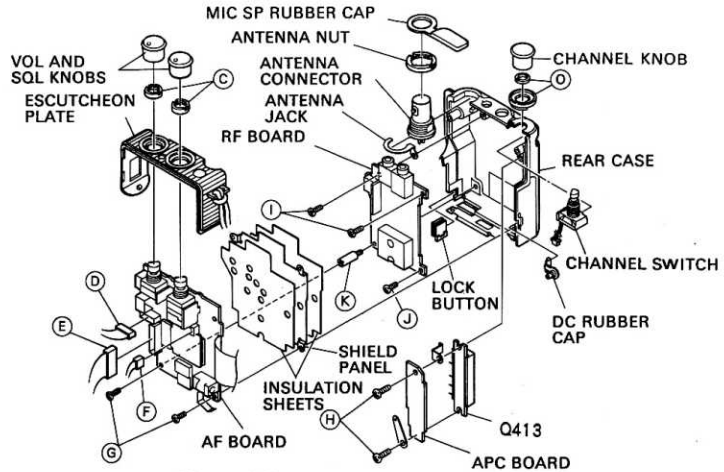


Figure 4-5

## 4.2 Option Installation

### 4.2.1 CTN160 (The MODEL C168A comes with the CTN160 already installed.)

- NOTE:**
1. Firmly plug the CTN160 into the connector as far as it will go. If it is not well seated malfunctions or damage may result.
  2. Plugging in the CTN160 at an angle or pulling up on it after it has been installed could damage it.
  3. There is no need to reset the microprocessor.
- a) After removing the bottom cover and front case, turn the unit over so that the control panel (the side with the display) is facing up. Grip the control panel case and slowly open it.
  - b) Place the CTN160 on top of the microprocessor and slide it to the connector as shown in Figure 4-6. Then plug it firmly into the connector.
  - c) Replace the front case and back cover so that they fit together. As shown in Figure 4-2, secure the front case in place by screwing in the two body and bottom cover fixing screws (B).
  - d) Replace the electrical contact screw (A) which was removed earlier (Figure 4-2). First inserting the electrical contact back into the lock button groove and then secure it with the screw.
  - e) This completes the CTN160 installation procedure. Tone squelch operation is now possible.

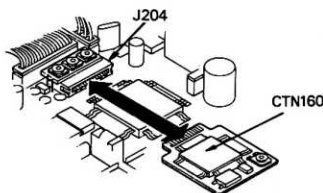


Figure 4-6

#### 4.2.2 CMU161

- NOTE:**
1. If the unit is connected to an external power supply, make sure the power has been switched off before installing the CMU161.
  2. Firmly plug the memory unit (CMU161) into the connector as far as it will go. If it is not well seated malfunctions or damage may result.
  3. Plugging in the memory unit (CMU161) backwards could damage it.

- a) Remove the battery case from the main unit as shown in Figure 4-7. The connector for the memory unit (CMU161) is located on the base of the main unit.

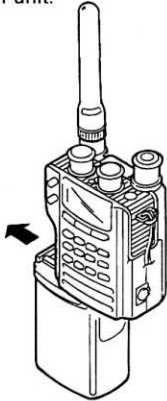


Figure 4-7

- b) Unplug the memory unit (CMU160) which is already installed. Insert the tip of a pair of tweezers or similar instrument into the hole in the memory unit (CMU160) and pull it out. (As shown in Figure 4-8)

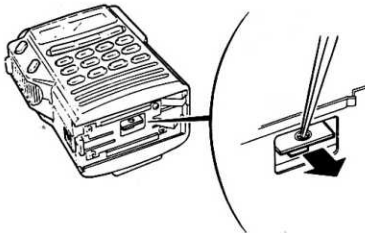


Figure 4-8

- c) Plug in the new memory unit (CMU161). The memory unit (CMU161) should be inserted straight and with the back facing up as shown in Figure 4-9.

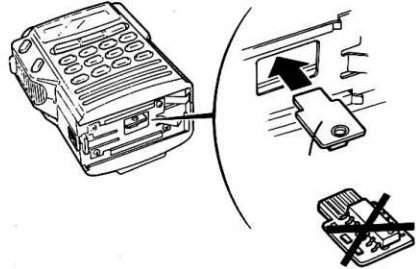


Figure 4-9

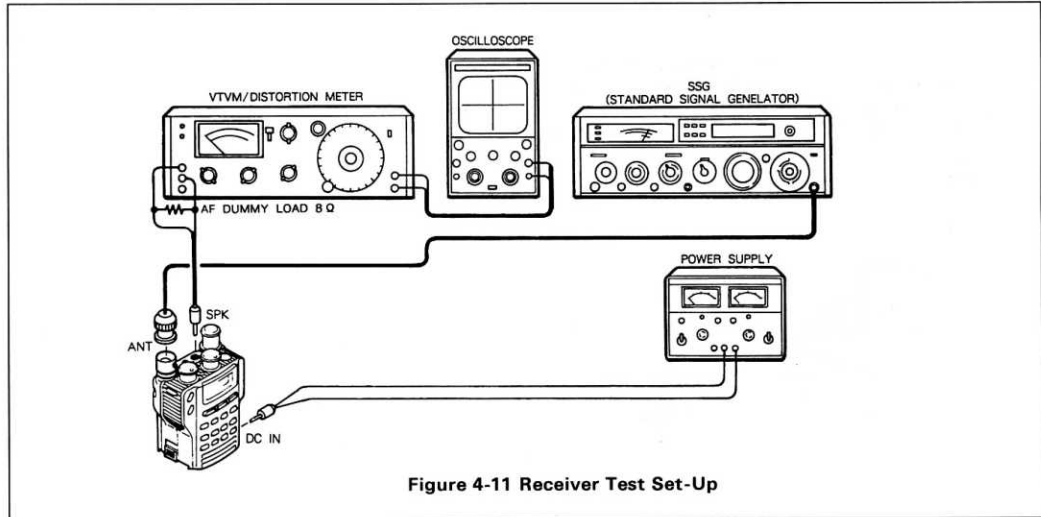
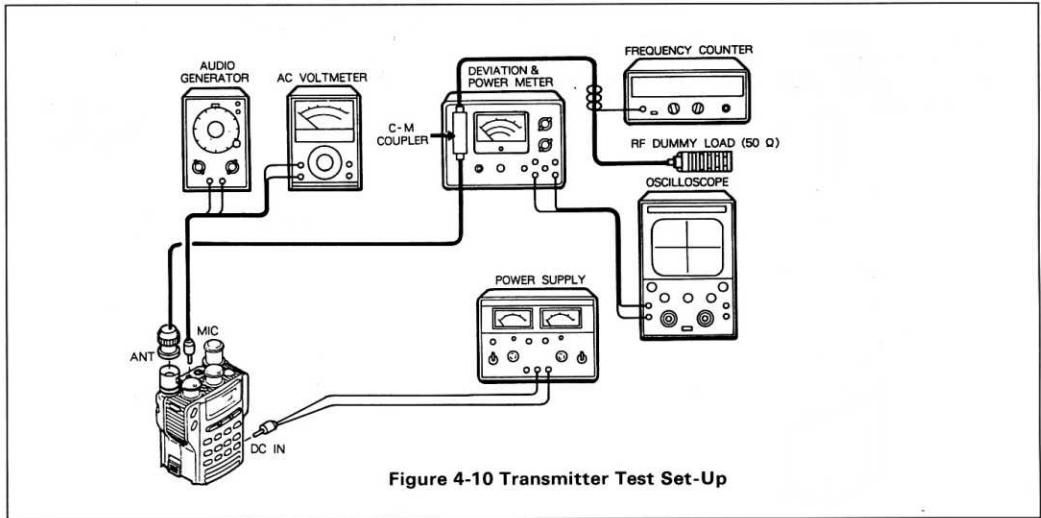
### 4.3 Test Set-Up

Be sure to correctly adjust instruments only.  
Warm up the instruments for at least 30 minutes before.

– **General Conditions** –

Supply voltage ..... 7.2 V DC  
Audio Output power ..... 75 mW  
AF dummy load ..... 8  $\Omega$   
Standard modulation .....  $\pm 3.5$  kHz at 1 kHz

RF dummy load ..... 50  $\Omega$   
Alignment frequency Receive ..... 146.050 MHz  
Transmit ..... 146.000 MHz



## 4.4 Alignment Reference Points

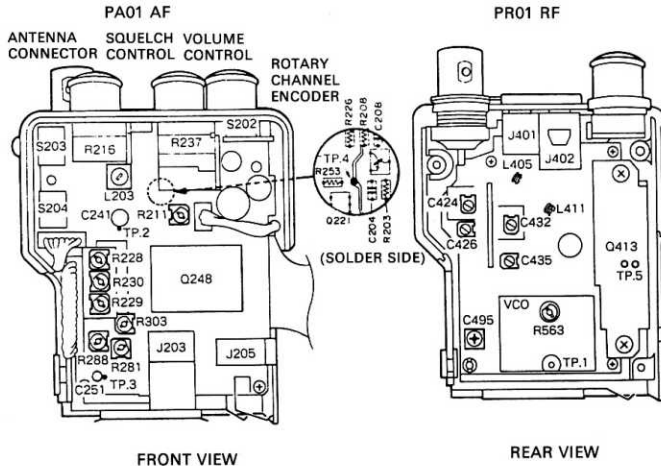


Figure 4-12

## 4.5 Alignment

### 4.5.1 Current Consumption Check

- After applying 7.2 V from the stabilized power supply, switch on the power.
- Turn the squelch control knob all the way clockwise.
- Confirm that the amperage of the power being supplied to the unit from the stabilized power supply is approximately 32 mA.

### 4.5.2 Power Supply Line Check

#### – 4 V System and 5 V System Regulator Check –

- Connect the voltmeter to TP2.
- Confirm that the reading of the voltmeter connected to TP2 is between 4.75 and 5.25 V.
- Connect the voltmeter to TP3.
- Confirm that the reading of the voltmeter connected to TP3 is between 3.8 and 4.2 V.

### 4.5.3 PLL Block

#### – VCO Voltage Check –

- Set the transceiver display frequency to 146.000 (receive status).
- Connect the voltmeter to TP1.
- Confirm that the reading of the voltmeter connected to TP1 is between 0.40 and 0.70 V.
- Put the transceiver into transmit status. (Press the PTT button.)
- Confirm that the reading of the voltmeter connected to TP1 is between 0.80 and 1.10 V.

#### – Local Frequency Adjustment –

- Set the transceiver display frequency to 146.000
- Put the transceiver into transmit status. (Press the PTT button.)
- Check the frequency of the output passing through the directional connector using a frequency counter.
- Adjust C467 so that the frequency counter reading is 146 MHz  $\pm$ 50 Hz

#### 4.5.4 Receiver

**NOTE:** Perform the following adjustments without removing the shield attached to the RF circuit board.

##### – Sensitivity Adjustment –

- a) Turn the transceiver's squelch control knob all the way counterclockwise.
- b) Set the transceiver display frequency to 146.050 and the output frequency from the SSG to the transceiver to 146.050 MHz.
- c) Connect the voltmeter to TP4.
- d) Raise the SSG output level until the reading of the voltmeter connected to TP4 is approximately 1.5 V.
- e) Adjust L405, L406, L407 and L408 in that order, so that the reading of the voltmeter connected to TP4 reaches the maximum level possible.
- f) Adjust L203 so that the audio output level of the speaker reaches the maximum level possible.

##### – 12 dB SINAD Check –

- a) Set the transceiver display frequency to 146.050 and the output frequency from the SSG to the transceiver to 146.050 MHz.
- b) Confirm that 12 dB SINAD is  $-9.5$  dB or less.
- c) Confirm that 12 dB SINAD is within  $1.0$  dB $\mu$  of the values listed in step b) above within the frequency range  $144.000 \sim 147.995$  MHz.

##### – 20 dB QS Check –

- a) Set the transceiver display frequency to 146.050 and the output frequency from the SSG to the transceiver to 146.050 MHz.
- b) Confirm that 20 dB QS is  $-7$  dB or less.

##### – First Image Check –

- a) With the transceiver display frequency set to 148.050 and the output frequency from the SSG to the transceiver to 86.350 MHz (MODEL C468), confirm that the first image ratio is 70 dB.

##### – S/N Check –

- a) With the transceiver display frequency set to 146.050 and the output frequency from the SSG to the transceiver to 146.050 MHz, confirm that the S/N ratio is 48 dB or greater.

**NOTE:** If the above values do not conform to the specification, re-perform the 4.5.4 receiver block sensitivity adjustment and check items.

##### – Signal Strength Meter Check –

- a) Set the transceiver display frequency to 146.050, the output frequency from the SSG to the transceiver to 146.050 MHz and the output level to 20 dB.
- b) Adjust R211 so that all segments of the signal strength meter light (Figure 4-13).



Figure 4-13

- c) Set the transceiver to receive within the frequency range  $144.000 \sim 147.995$  MHz.
- d) Confirm that the SSG output level is between  $16$  dB $\mu$  and  $24$  dB $\mu$  when the signal strength meter reading is at its maximum.



#### 4.5.5 Transmitter

**NOTE:** Perform the following adjustments without removing the shield attached to the RF circuit board.

Also, in order to obtain accurate transmission output the – (negative) terminal of the stabilized power supply should be connected to the chassis of the RF board as a reinforced ground, in addition to the power connection between the stabilized power supply and the CD jack. A thick cable capable of withstanding current in excess of 2 A and equipped with an alligator clip should be used to make the ground connection.

##### – Maximum Transmission Output Adjustment and Check –

- Apply 13.8 V from the stabilized power supply.
- Set the transmission mode to high power.
- Set the transceiver display frequency to 146.000 and transmit.
- Turn R229 all the way clockwise.
- Confirm that the maximum transmission output level is 6.0 W or greater.

##### – Transmission Output Adjustment and Check –

- Apply 7.2 V from the stabilized power supply.
- Set the transmission mode to low power.
- Adjust R228 so that the transmission output level is 0.35 W. Confirm that at this point the current consumption is between 280 mA and 400 mA.
- Apply 13.8 V from the stabilized power supply.
- Set the transmission mode to high power.
- Adjust R229 so that the transmission output level is 5.1 W. Confirm that the current consumption is between 800 mA and 1,200 mA.
- Set the transmission mode to medium power.
- Adjust R230 so that the transmission output level is 2.5 W. Confirm that the current consumption is between 500 mA and 900 mA.
- Apply 6.0 V from the stabilized power supply.
- Set the transmission mode to high power.
- Confirm that the transmission output level is 1.0 W or greater.

##### – Power Balance Check –

- Apply 13.8 V from the stabilized power supply.
- Set the transmission mode to high power.
- Transmit within the frequency range 144.000 ~ 147.995 MHz.
- Confirm that the gap between the maximum and minimum transmission output levels is 0.55 W or less.
- Set the transmission mode to medium power.
- Confirm that the gap between the maximum and minimum transmission output levels is 0.55 W or less.
- Apply 7.2 V from the stabilized power supply.
- Set the transmission mode to low power.
- Confirm that the gap between the maximum and minimum transmission output levels is 0.06 W or less.

##### – Thermal Sensor Check –

- Apply 13.8 V from the stabilized power supply.
- Set the transmission mode to high power.
- After setting the transceiver display frequency to 146.000, short TP5 and transmit. Confirm that at this point the transmission output level is between 2.0 W and 3.2 W.

##### – Deviation Adjustment and Check –

- Apply 7.2 V from the stabilized power supply.
- Set the transceiver display frequency to 146.000 and transmit.
- Turn on the 750  $\mu$ sec. filter of the direct wired detector.
- Insert a micro-plug configured as shown in Figure 4-14 into the EXT MIC jack. Then input a 1 kHz, 60 mV sine wave from the AG.
- Adjust R288 so that deviation is  $\pm 5.0$  kHz.
- With deviation at  $\pm 5.0$  kHz, confirm that the gap between the plus and minus range frequencies is no more than 0.3 kHz.
- Adjust the AG output so that the deviation is  $\pm 3.5$  kHz. Confirm that the distortion is no more than 4%.
- After performing step g) above, remove the micro-plug from the AG.
- Confirm that the AG open output voltage is AC 4 mV ~ 8 mV and that the modulation distortion is no more than 4%.

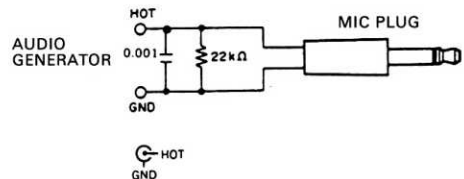


Figure 4-14

**– Internal Tone Adjustment and Check –  
(Adjustment/Confirmation for the  
MODEL 168A)**

- a) Apply 7.2 V from the stabilized power supply.
- b) Set the transceiver display frequency to 146.000.
- c) Insert a micro-plug configured as shown in Figure 4-14 into the EXT MIC jack. Transmit the AG output at 0 mV.
- d) Set the high-pass filter of the direct wired detector to 50 Hz and the low-pass filter to 20 kHz.
- e) With the transceiver in transmit status and the call button depressed, adjust R303 so that the deviation is  $\pm 3.5$  kHz.
- f) The distortion is no more than 7%.

**– Internal Tone Adjustment and Confirmation –**

- a) Apply 7.2 V from the stabilized power supply.
- b) Set the transceiver display frequency to 444.00.
- c) Turn on the repeater. Set the offset frequency to 0.00 MHz and the internal tone frequency to 88.5 Hz.
- d) Insert a micro-plug configured as shown in Figure 4-14 into the EXT MIC jack. Transmit the AG output at 0 mV.
- e) Set the high-pass filter of the direct wired detector to OFF and the low-pass filter to 3 kHz.
- f) Adjust R303 so that the deviation is  $\pm 0.7$  kHz.
- g) Confirm that the tone frequency is 88.5 Hz  $\pm 0.3$  Hz and that the distortion is no more than 7%.

**– DTMF (Deviation) Adjustment and Check –**

- a) Apply 7.2 V from the stabilized power supply.
- b) Set the transceiver display frequency to 146.000 and transmit.
- c) Insert a micro-plug configured as shown in Figure 4-14 into the EXT MIC jack. Transmit the AG output at 0 mV.
- d) Hold down the "8/RPT" key and adjust R281 so that the deviation is  $\pm 3.2$  kHz.

**4.5.6 Tone Squelch Unit**

**– CTN160 (Already installed on the  
MODEL 168A.) –**

- a) Apply 7.2 V from the stabilized power supply.
- b) Switch on the power to the transceiver.
- c) Set the transceiver display frequency to 146.000 and activate the tone squelch function.
- d) Set the tone frequency to 67.0 Hz.
- e) Confirm that the deviation is  $\pm 0.5$  kHz  $\sim \pm 0.9$  kHz and that the distortion is no more than 15%.
- f) Set the tone frequency to 250.3 Hz. Confirm that the deviation is  $\pm 0.5$  kHz  $\sim \pm 0.9$  kHz and that the distortion is no more than 15%.
- g) If any of the adjustment values in steps d) through f) above do not conform to the specification, set the transceiver display frequency to 146.000 and the tone frequency to 250.3 Hz.
- h) Adjust R805 so that deviation is  $\pm 0.7$  kHz.

P001 TONE SQUELCH BOARD

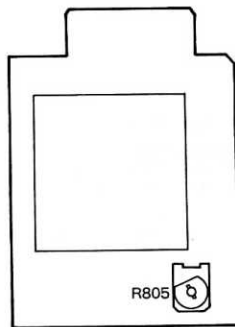


Figure 4-15

## 5. SPECIFICATIONS

### 5.1 Transceiver

#### 5.1.1 General

Frequency Range	144.000 ~ 147.995 MHz			
Tuning steps	5, 10, 12.5, 20, 25, 50, 75, 100 kHz			
Modulation Type	F3			
Input Voltage	DC 7.2 V			
Current consumption	Transmitting	13.8 V	High power	Approx. 1,000 mA
			Medium power	Approx. 800 mA
		7.2 V	High power	Approx. 900 mA
			Medium power	Approx. 900 mA
		13.8/7.2 V	Low power	Approx. 400 mA
Receiving	Approx. 32 mA			
With battery save enabled	Approx. 12 mA			
With auto power-off enabled	Approx. 0.5 mA			
Microphone input impedance	600 $\Omega$			
Speaker impedance	8 $\Omega$			
Dimensions (excluding protrusions)	0.47 in (H) x 0.19 in (W) x 0.12 in (D) (120 mm (H) x 47 mm (W) x 31 mm (D))			
Weight	0.64 lb. (290 g) (including antenna and CBT160)			

#### 5.1.2 Receiver

– Measurements are made in accordance with EIA ATR-04 –

Receiver System	Double conversion super heterodyne
Intermediate Frequencies	First IF 30.85 MHz (Lower)
	Second IF 455 kHz (Lower)
Reception sensitivity (12 dB SINAD)	0.158 $\mu$ V
0.5 $\mu$ V input S/N ratio	Better than 30 dB
Squelch open sensitivity	0.1 $\mu$ V
Low frequency output	200 mW (8 $\Omega$ , 10% distortion)

#### 5.1.3 Transmitter

– Measurements are made in accordance with EIA ATR-03 –

RF Output power	High power	1.0 W (with CBT160)
		1.5 W (with CNB160)
		2.8 W (with CNB161/CNB163)
Medium power	5.0 W (with CNB162)	
	1.0 W (with CBT160)	
	2.3 W (with CNB160)	
Low power	2.5 W (with CNB161/CNB163)	
	2.5 W (with CNB162)	
	0.35 W	
Spurious ratio	Better than -60 dB	
Maximum frequency deviation	$\pm$ 5 kHz	
Modulation method	Reactance modulation	

### 5.1.4 Internal DTMF

– Encoder –

Tone frequency (f) .....  $697 \leq f \leq 1,633$  Hz  
Tone frequency deviation .....  $\pm 3.2$  kHz

– Decoder –

Squelch open sensitivity .....  $\leq 20$  dB SINAD  
Squelch open sensitivity value obtained when conditions a) through d) below are met.

- a) The modulation frequency is flat.
- b) Deviation with the "8" key depressed is  $\pm 3.2$  kHz.
- c) Paging mode operating at  $777 * 777$ .
- d) Operating with a signal timing of 50 msec. ON, 50 msec. OFF for each digit of the transmission code.

### 5.2 Options

#### 5.2.1 CNT160 (The MODEL C168A comes with the CTN160 already installed.)

Input voltage .....  $4.5 \sim 5.5$  V

– Encoder –

Tone frequency (f) .....  $67.0 \leq f \leq 250.3$  Hz  
Tone frequency deviation .....  $\pm 0.5\%$   
Output level (at max. volume) .....  $\leq 530 \pm 20$  mV  
Tone frequency distortion .....  $\leq 10\%$

– Decoder –

Open level .....  $\leq 22$  mV (at 179.9 Hz)  
Response time .....  $\leq 220$  msec. (at 166.2 Hz)  
Current consumption .....  $\leq 8$  mA (max.)

Performance specifications are nominal, unless otherwise indicated, and are subject to change without notice.

## 6. EXPLODED PARTS VIEW AND PARTS LIST

### – General –

- Information on most electrical and mechanical parts is included in the parts list. The parts are listed by reference symbols in alphanumeric order.

### – Chips Parts –

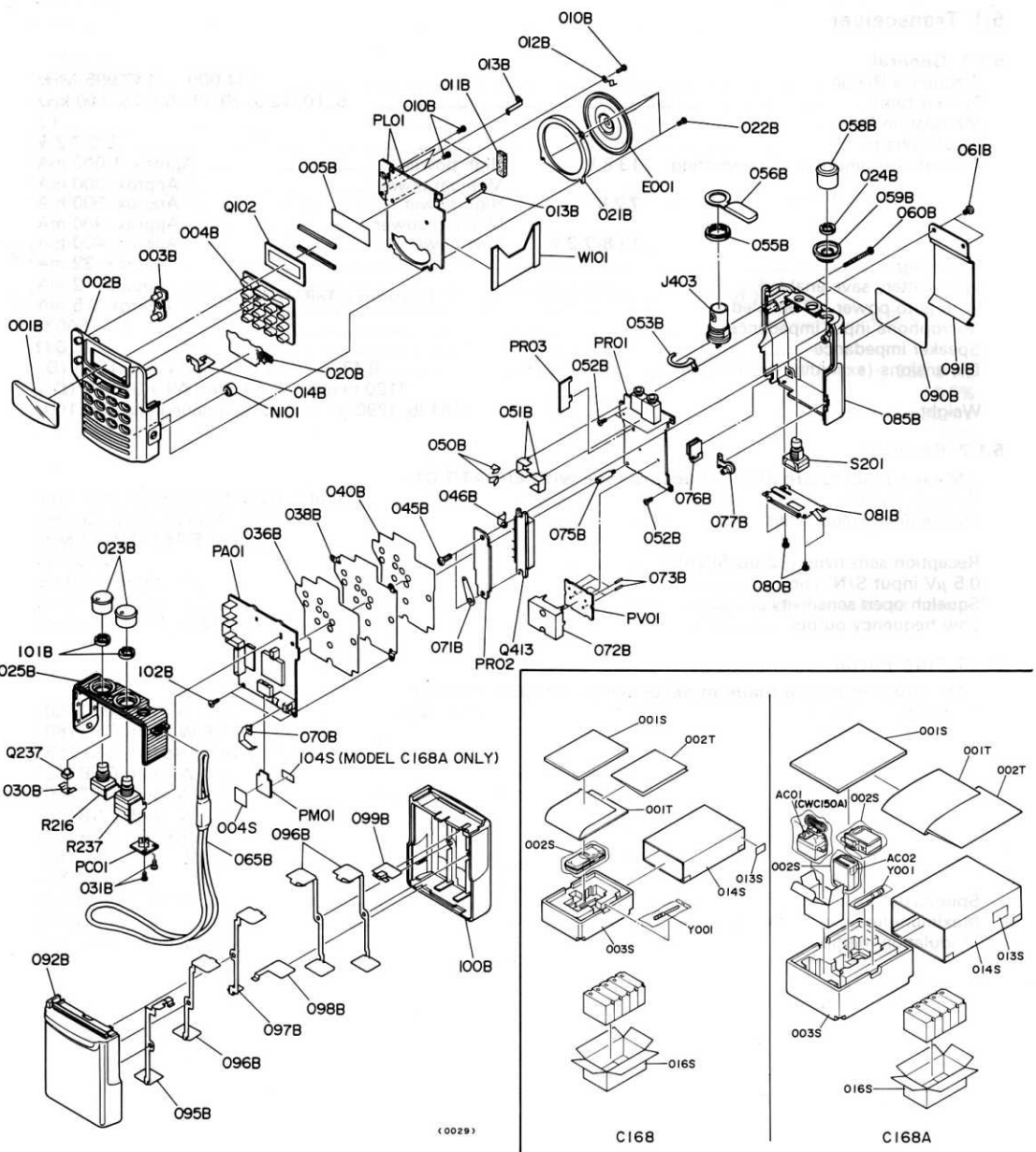
First through fourth digital of part number indicates chip part as follows:

– CAPACITORS –	– RESISTORS –	– SEMICONDUCTORS –	– INDUCTOR –
DD4 .....	NI .....	BA .....	LU .....
DD5 .....	NN .....	HX .....	
DD9 .....	NY .....	HY .....	
DF9 .....	RI .....	HZ .....	
DK4 .....			
DK5 .....			
DK9 .....			
EY .....			

### – Ordering Replacement Parts –

Please note that dealer may not be able to fill replacement parts orders without such identifying information as:

- ◆ Reference Symbol
- ◆ Parts Number
- ◆ Description
- ◆ Unit Model Serial Number



(0029)

C168

C168A

REF. DESIG.	QTY	PART NO.	DESCRIPTION		REF. DESIG.	QTY	PART NO.	DESCRIPTION	
<b>MECHANISM</b>									
001B	1	123X158020	LCD WINDOW	[A]	090B	1	123X265030	MODEL NAME PLATE	[A]
001B	1	123X158010	LCD WINDOW	[B]	090B	1	124X265040	MODEL NAME PLATE	[B]
002B	1	123X064020	FRONT CASE		091B	1	124X160010	BELT CLIP	
003B	1	124X270030	LAMP/SQUELCHI BUTTON		092B	1	124X804030	BATTERY FRONT CASE	[B]
004B	1	124X270020	TEN KEY BUTTON		095B	1	124X123010	CONTACTOR FOR BATTERY CASE	[B]
005B	1	124X107010	SHEET FOR DISPLAY P.C.BOARD		096B	3	124X123030	CONTACTOR FOR BATTERY CASE	[B]
010B	5	124X010020	SCREW		097B	1	124X123020	CONTACTOR FOR BATTERY CASE	[B]
011B	1	061X056010	BUFFER FOR DISPLAY P.C.BOARD		098B	1	124X123040	CONTACTOR FOR BATTERY CASE	[B]
012B	1	124X116020	SPEAKER EARTH SPRING		099B	1	124X123050	CONTACTOR FOR BATTERY CASE	[B]
013B	2	032X129010	EARTH TERMINAL		100B	1	124X064050	BATTERY REAR CASE	[B]
014B	1	124X123080	EARTH CONTACTOR		101B	2	302C011010	VOLUME NUT	
020B	1	124X202010	SPEAKER NET		102B	3	51821703A0	P.H.M.SCREW P17X3	
021B	1	124X118010	SPEAKER SPACER		103B	1	062X118010	EARTH SPRING	
022B	3	124X010030	SCREW		<b>PACKING</b>				
023B	2	124X154020	VOLUME/SQUELCH CONTROL KNOB		001S	1	296Z809020	LID FOR CUSHION	
024B	1	302C011010	VOLUME NUT		002S	2	124X811010	POLYETHYLENE BAG	[A]
025B	1	124X063500	RUBBER ESCUTCHEON		002S	1	9011020010	POLYETHYLENE BAG	[B]
026B	1	124X063010	BRACKET		003S	1	124X809020	CUSHION	[A]
030B	1	124X157010	LED TAPE		003S	1	124X809010	CUSHION	[B]
031B	2	124X010040	SCREW		004S	1	153X861010	LABEL FOR ROM	
036B	1	123X120010	INSULATOR FOR AF P.C.BOARD		013S	1	9523019010	SERIAL NO. LABEL	
038B	1	123X109010	SHIELD FOR AF P.C.BOARD		014S	1	123X804040	SLEEVE	[A]
040B	1	123X120020	INSULATOR FOR AF P.C.BOARD		014S	1	123X804030	SLEEVE	[B]
045B	2	51082606S0	P.H.M. SCREW P2.6X8		016S	1	123X805040	MASTER CARTON	[A]
046B	1	102X123010	RF EARTH CONTACTOR		016S	1	123X805030	MASTER CARTON	[B]
050B	2	124X118030	RF EARTH SPRING		001T	1	124X851010	INST	[A]
051B	2	102X109020	SHIELD FOR AF P.C.BOARD		001T	1	124X851020	INST	[B]
052B	2	51821703A0	P.H.M. SCREW P7X3		002T	1	123X856030	CIRCUIT DIAGRAM	[A]
053B	1	124X123070	ANTENNA CONTACTOR		002T	1	123X856020	CIRCUIT DIAGRAM	[B]
055B	1	224C011010	ANTENNA NUT		Y001	1	YR9901103R	FLEXIBLE ANTENNA	
058B	1	061X067010	MICROPHONE & SPEAKER CAP		AC01	1		WALL CHARGER CWC151A	[A]
058B	1	124X154010	CHANNEL KNOB		AC02	1		NI- CD BATTERY PACK CNB161	[A]
059B	1	124X353010	CHANNEL RING						
060B	2	124X010010	SCREW						
061B	2	51102603S0	B.H.M. SCREW B2.6X3						
065B	1	061X156010	HAND STRAP						
070B	1	124X123060	CONTACTOR FOR BATTERY TERMINAL						
071B	1	62031340W0	LUG FOR APC P.C.BOARD						
072B	1	124X109010	SHIELD FOR VCO P.C.BOARD						
073B	7	097X254010	POSTPIN						
074B	1	124X120030	INSULATOR FOR VCO						
075B	1	124X101010	STUD						
076B	1	124X270010	LOCK BUTTON						
077B	1	061X067020	DC CAP						
080B	4	124X010050	P.H.M. SCREW P2X3						
081B	1	124X118010	LEAF SPRING						
085B	1	124X064010	REAR CASE						

REF. DESIG.	QTY	PART NO.	DESCRIPTION		
			<b>PA01 AF P.C.BOARD</b>		
<b>PA01</b>	<b>1</b>	<b>WZ123X2210</b>	<b>AF P.C.BOARD</b>		
C201	1	DD95180300	18 PF	+ - 5 %	CH
C202	1	DK98103200	0.01 UF	+ - 10 %	
C203	1	DK98102300	0.001 UF	+ - 10 %	
C204	1	DK98223200	0.022 UF	+ - 10 %	
C205	1	DK98223200	0.022 UF	+ - 10 %	
C206	1	DK46224200	0.22 UF	+ - 10 %	
C207	1	DK46224200	0.22 UF	+ - 10 %	
C208	1	DD95221300	220 PF	+ - 5 %	CH
C209	1	KC097X001R	TANTAL CAP 4.7 UF/6.3 V		
C214	1	DK98223200	0.022 UF	+ - 10 %	
C215	1	DD95330300	33 PF	+ - 5 %	CH
C216	1	DD95250300	25 PF	+ - 5 %	CH
C217	1	DD98330300	33 PF	+ - 10 %	
C218	1	DK98102300	0.001 UF	+ - 10 %	
C219	1	EY33600630	TANTAL CAP 33 UF/6.3 V		
C220	1	DK56473200	0.047 UF	+ - 10 %	
C221	1	DK56473200	0.047 UF	+ - 10 %	
C222	1	DK98273200	0.027 UF	+ - 10 %	
C223	1	DK56104200	0.1 UF	+ - 10 %	
C224	1	KC097X002R	TANTAL CAP 10 UF/6.3 V		
C225	1	DK98102300	0.001 UF	+ - 10 %	
C226	1	EJ10700610	ELECT CAP 100 UF/6.3 V		
C227	1	DK98102300	0.001 UF	+ - 10 %	
C228	1	EJ10700610	ELECT CAP 100 UF/6.3 V		
C229	1	DK5668320R	0.088 UF	+ - 10 %	
C230	1	EY10501610	TANTAL CAP 1 UF/16 V		
C231	1	DK98223200	0.022 UF	+ - 10 %	
C234	1	DK98102300	0.001 UF	+ - 10 %	
C235	1	DK98102300	0.001 UF	+ - 10 %	
C236	1	EY10501610	TANTAL CAP 1 UF/16 V		
C237	1	DK98273200	0.027 UF	+ - 10 %	
C238	1	DK98152300	0.0015 UF	+ - 10 %	
C239	1	DK986230R	0.0058 UF	+ - 10 %	
C240	1	KC097X001R	TANTAL CAP 4.7 UF/6.3 V		
C241	1	EY33600620	ELECT CAP 33 UF/6.3 V		
C242	1	DK98273200	0.027 UF	+ - 10 %	
C243	1	DK98102300	0.001 UF	+ - 10 %	
C245	1	DK98102300	0.001 UF	+ - 10 %	
C246	1	DK98102300	0.001 UF	+ - 10 %	
C247	1	EJ1070161R	ELECT CAP 100 UF/16 V		
C248	1	DK98102300	0.001 UF	+ - 10 %	
C249	1	EY33600620	ELECT CAP 33 UF/6.3 V		
C250	1	KC097X001R	TANTAL CAP 4.7 UF/6.3 V		
C251	1	EY33600620	ELECT CAP 33 UF/6.3 V		
C252	1	DK98102300	0.001 UF	+ - 10 %	
C253	1	DK98102300	0.001 UF	+ - 10 %	
C255	1	KC124X001R	TANTAL CAP 330 UF/6.3 V		
C256	1	DD95270300	27 PF	+ - 5 %	CH
C257	1	DD95250300	25 PF	+ - 5 %	CH
C258	1	DK5815420R	0.15 UF	+80 %, -20 %	
C259	1	DK98102300	0.001 UF	+ - 10 %	
C260	1	DK98223200	0.022 UF	+ - 10 %	
C261	1	DD95470300	47 PF	+ - 5 %	CH
C262	1	DD95470300	47 PF	+ - 5 %	CH
C263	1	KC097X001R	TANTAL CAP 4.7 UF/6.3 V		
C264	1	DK98273200	0.027 UF	+ - 10 %	

REF. DESIG.	QTY	PART NO.	DESCRIPTION		
			<b>PA01 AF P.C.BOARD</b>		
C265	1	DK98102300	0.001 UF	+ - 10 %	
C266	1	DK98102300	0.001 UF	+ - 10 %	
C267	1	DK46826200	0.0058 UF	+ - 10 %	[B]
C268	1	DD95680300	68 PF	+ - 5 %	CH
C269	1	DK5682330R	0.082 UF	+80 %, -20 %	
C270	1	KC097X001R	TANTAL CAP 4.7 UF/6.3 V		
C271	1	DK46224200	0.22 UF	+ - 10 %	[A]
C272	1	DK46224200	0.22 UF	+ - 10 %	[A]
C272	1	DK46826200	0.0058 UF	+ - 10 %	[B]
C273	1	DK98471300	470 PF	+ - 10 %	
C274	1	DK98222300	0.0022 UF	+ - 10 %	
C275	1	DK98103200	0.01 UF	+ - 10 %	
C276	1	DK98103200	0.01 UF	+ - 10 %	
C277	1	DK5668320R	0.088 UF	+ - 10 %	
C278	1	DK98102300	0.001 UF	+ - 10 %	
C279	1	DK98102300	0.001 UF	+ - 10 %	
C280	1	DK98102300	0.001 UF	+ - 10 %	
C281	1	DK98103200	0.01 UF	+ - 10 %	
C282	1	DK98102300	0.001 UF	+ - 10 %	
C283	1	DK98103200	0.01 UF	+ - 10 %	
C284	1	DK98103200	0.01 UF	+ - 10 %	
C285	1	DK98103200	0.01 UF	+ - 10 %	
C286	1	DK98103200	0.01 UF	+ - 10 %	
C287	1	DD91100300	10 PF	+ - 0.5 PF	CH
C288	1	DK5668320R	0.088 UF	+ - 10 %	
C293	1	DK5882330R	0.082 UF	+80 %, -20 %	
F201	1	FG455304E3	CERAMIC FILTER 455 KHZ		
J201	1	YJ0700515R	15 PIN JACK		
J202	1	YJ0700516R	7 PIN JACK		
J203	1	YJ0700513R	5 PIN JACK		
J204	1	YJ0700514R	10 PIN JACK		
J205	1	YJ04001630	DC IN JACK		
J206	1	YJ0700517R	3 PIN JACK		
L201	1	LU12102010	CHIP INDUCTOR 1 UH		
L202	1	FC9002003R	FERRITE CORE BLM21A05PT		
L203	1	LA5012602R	ANTENNA COIL 455 KHZ		
L204	1	FC9002003R	FERRITE CORE BLM21A05PT		
L205	1	LU12102010	CHIP INDUCTOR 1 UH		
Q201	1	HZ2000520R	DIODE MA716		
Q202	1	HX346171BR	TRANSISTOR 2SC4617(R)		
Q203	1	HC10019420	IC TK10487M		
Q204	1	BA9000621R	DIGITAL TRANSISTOR UMA9		
Q205	1	BA9000621R	DIGITAL TRANSISTOR UMA9		
Q206	1	HZ2002502R	DIODE MA132WA		
Q207	1	HZ2002502R	DIODE MA132WA		
Q208	1	BA9000621R	DIGITAL TRANSISTOR UMA9		
Q209	1	HZ2002502R	DIODE MA132WA		
Q210	1	HZ2002502R	DIODE MA132WA		
Q211	1	BA1003621R	DIGITAL TRANSISTOR DTA144EE		
Q212	1	HX346171BR	TRANSISTOR 2SC4617(R)		
Q213	1	BA2004321R	DIGITAL TRANSISTOR DTC144EE		
Q214	1	HC10098090	IC NJM2070M		
Q216	1	HC405305SR	IC TC4W53F		
Q217	1	BA1000905R	DIGITAL TRANSISTOR RN8003		
Q217	1	BA1000306R	DIGITAL TRANSISTOR HQ1A4A		
Q218	1	BA9000821R	DIGITAL TRANSISTOR UMW1		
Q219	1	HC98A3953R	IC SCI7710YKA		



REF. DESIG.	QTY	PART NO.	DESCRIPTION	
<b>PA01 AF P.C.BOARD</b>				
Q220	1	HZ2002802R	DIODE MA132WK	
Q221	1	BA9000721R	DIGITAL TRANSISTOR UMX1	
Q223	1	HD2002801R	DIODE VO6C	
Q224	1	HD2002801R	DIODE VO6C	
Q225	1	BA1000905R	DIGITAL TRANSISTOR RN8003	
Q226	1	BA9000821R	DIGITAL TRANSISTOR UMW1	
Q227	1	BA1001005R	DIGITAL TRANSISTOR RN2425	
Q228	1	BA9000821R	DIGITAL TRANSISTOR UMW1	
Q229	1	BA1001005R	DIGITAL TRANSISTOR RN2425	
Q230	1	BA9000821R	DIGITAL TRANSISTOR UMW1	
Q231	1	BA1000905R	DIGITAL TRANSISTOR RN8003	
Q232	1	BA9000821R	DIGITAL TRANSISTOR UMW1	
Q233	1	HC1003053R	IC S - 80733AL - AX	
Q234	1	HC10018320	IC LR40872	
Q235	1	HX327121C0	TRANSISTOR 25C2712(Y)	
Q236	1	HZ3000502R	ZENER DIODE MA8039 - H	
Q237	1	HI1007702R	LED LN15WP	
Q238	1	HC1005709R	IC NJM4558E	
Q239	1	HZ3000602R	ZENER DIODE MA8075	
Q240	1	BA1000802R	DIGITAL TRANSISTOR UN911H	
Q241	1	BA20021210	DIGITAL TRANSISTOR DTC144EU	
Q242	1	HZ2001221R	DIODE DA112	[B]
Q243	1	HZ2001221R	DIODE DA112	[A]
Q243	1	HZ20008210	DIODE DA204U	[B]
Q244	1	HZ2001221R	DIODE DA112	[A]
Q244	1	HZ20008210	DIODE DA204U	[B]
Q245	1	HZ2002802R	DIODE MA111	
Q246	1	HZ2003405R	DIODE HN2D01F	
Q247	1	HZ2002802R	DIODE MA111	
Q248	1	HZ20008210	MICROPROCESSOR UPD75108AG	
Q249	1	HZ20029050	DIODE 1SS314	
R201	1	NN05102810	1 KOHM + - 5 % 1/16 W	
R202	1	NN05102810	1 KOHM + - 5 % 1/16 W	
R203	1	NN05332810	3.3 KOHM + - 5 % 1/16 W	
R204	1	NN05474810	470 KOHM + - 5 % 1/16 W	
R205	1	NN05103810	10 KOHM + - 5 % 1/16 W	
R206	1	NN05223810	22 KOHM + - 5 % 1/16 W	
R207	1	NN05474810	470 KOHM + - 5 % 1/16 W	
R208	1	NN05471810	470 OHM + - 5 % 1/16 W	
R209	1	NN05101810	100 OHM + - 5 % 1/16 W	
R210	1	NN05102810	1 KOHM + - 5 % 1/16 W	
R211	1	NY02030050	TRIMMING RESISTOR 20 KOHM (B)	
R212	1	NN05102810	1 KOHM + - 5 % 1/16 W	
R213	1	NN05103810	10 KOHM + - 5 % 1/16 W	
R214	1	NN05223810	22 KOHM + - 5 % 1/16 W	
R218	1	NN05223810	22 KOHM + - 5 % 1/16 W	
R219	1	NN05581810	580 OHM + - 5 % 1/16 W	
R220	1	NN05153810	15 KOHM + - 5 % 1/16 W	
R221	1	NN05470810	47 OHM + - 5 % 1/16 W	
R222	1	NN05103810	10 KOHM + - 5 % 1/16 W	
R223	1	NN05103810	10 KOHM + - 5 % 1/16 W	
R224	1	NN05473810	47 KOHM + - 5 % 1/16 W	
R225	1	NN05473810	47 KOHM + - 5 % 1/16 W	
R226	1	NN05222810	22 KOHM + - 5 % 1/16 W	

REF. DESIG.	QTY	PART NO.	DESCRIPTION	
<b>PA01 AF P.C.BOARD</b>				
R231	1	NN05473810	47 KOHM + - 5 % 1/16 W	
R232	1	NN0502281R	2.2 OHM + - 5 % 1/16 W	
R233	1	NN05331810	330 OHM + - 5 % 1/16 W	
R234	1	NN05002810	0 KOHM + - 5 % 1/16 W	
R235	1	NN05473810	47 KOHM + - 5 % 1/16 W	
R239	1	NN05474810	470 KOHM + - 5 % 1/16 W	
R240	1	NN05102810	1 KOHM + - 5 % 1/16 W	
R241	1	NN0502281R	2.2 OHM + - 5 % 1/16 W	
R242	1	NN05392810	3.9 KOHM + - 5 % 1/16 W	
R243	1	NN0591281R	9.1 KOHM + - 5 % 1/16 W	
R244	1	NN05102810	1 KOHM + - 5 % 1/16 W	
R245	1	NN05101810	100 OHM + - 5 % 1/16 W	
R246	1	NN05473810	47 KOHM + - 5 % 1/16 W	
R247	1	NN05223810	22 KOHM + - 5 % 1/16 W	
R248	1	NN05224810	220 KOHM + - 5 % 1/16 W	
R249	1	NN05103810	10 KOHM + - 5 % 1/16 W	
R250	1	NN05333810	33 KOHM + - 5 % 1/16 W	
R251	1	NN05333810	33 KOHM + - 5 % 1/16 W	
R252	1	NN05123810	12 KOHM + - 5 % 1/16 W	
R253	1	NN05102810	1 KOHM + - 5 % 1/16 W	
R254	1	NN05393810	39 KOHM + - 5 % 1/16 W	
R255	1	NN05224810	220 KOHM + - 5 % 1/16 W	
R256	1	NN05102810	1 KOHM + - 5 % 1/16 W	
R257	1	NN05473810	47 KOHM + - 5 % 1/16 W	
R258	1	NN05332810	3.3 KOHM + - 5 % 1/16 W	
R259	1	NN05583810	58 KOHM + - 5 % 1/16 W	
R280	1	NN05103810	10 KOHM + - 5 % 1/16 W	
R281	1	NN05000810	0 OHM 1/16 W	
R282	1	NN05103810	10 KOHM + - 5 % 1/16 W	
R283	1	NN05272810	2.7 KOHM + - 5 % 1/16 W	
R284	1	NN05221810	220 OHM + - 5 % 1/16 W	
R285	1	NN05222810	2.2 KOHM + - 5 % 1/16 W	
R286	1	NN05472810	4.7 KOHM + - 5 % 1/16 W	
R287	1	NN05103810	10 KOHM + - 5 % 1/16 W	
R288	1	NN05122810	1.2 KOHM + - 5 % 1/16 W	
R289	1	NN05473810	47 KOHM + - 5 % 1/16 W	
R270	1	NN05153810	15 KOHM + - 5 % 1/16 W	
R271	1	NN05583810	58 KOHM + - 5 % 1/16 W	
R272	1	NN05103810	10 KOHM + - 5 % 1/16 W	
R273	1	NN05221810	220 OHM + - 5 % 1/16 W	
R274	1	NN05222810	2.2 KOHM + - 5 % 1/16 W	
R275	1	NN05103810	10 KOHM + - 5 % 1/16 W	
R276	1	NN05222810	2.2 KOHM + - 5 % 1/16 W	
R277	1	NN05224810	220 KOHM + - 5 % 1/16 W	
R278	1	NN05000810	0 OHM 1/16 W	
R279	1	NN05000810	0 OHM 1/16 W	
R280	1	NN05104810	100 KOHM + - 5 % 1/16 W	
R281	1	NY01030050	TRIMMING RESISTOR 10 KOHM	
R282	1	NN05472810	4.7 KOHM + - 5 % 1/16 W	
R283	1	NN05473810	47 KOHM + - 5 % 1/16 W	
R284	1	NN05473810	47 KOHM + - 5 % 1/16 W	
R285	1	NN05474810	470 KOHM + - 5 % 1/16 W	
R286	1	NN05224810	220 KOHM + - 5 % 1/16 W	
R287	1	NN05224810	220 KOHM + - 5 % 1/16 W	
R288	1	NY01030050	TRIMMING RESISTOR 10 KOHM (B)	
R289	1	NN05104810	100 KOHM + - 5 % 1/16 W	

REF. DESIG.	QTY	PART NO.	DESCRIPTION
<b>PA01 AF P.C.BOARD</b>			
R290	1	NN05103810	10 KOHM +- 5 % 1/16 W
R291	1	NN05333810	33 KOHM +- 5 % 1/16 W
R292	1	NN05471810	470 OHM +- 5 % 1/16 W
R293	1	NN05221810	220 OHM +- 5 % 1/16 W
R294	1	NN05684810	680 KOHM +- 5 % 1/16 W
R295	1	NN05561810	580 OHM +- 5 % 1/16 W
R296	1	NN05222810	2.2 KOHM +- 5 % 1/16 W
R297	1	NN05333810	33 KOHM +- 5 % 1/16 W
R298	1	NN05473810	47 KOHM +- 5 % 1/16 W
R299	1	NN05333810	33 KOHM +- 5 % 1/16 W
R300	1	NN05473810	47 KOHM +- 5 % 1/16 W
R301	1	NN05473810	47 KOHM +- 5 % 1/16 W
R302	1	NN05333810	33 KOHM +- 5 % 1/16 W
R303	1	NY05040050	TRIMMING RESISTOR 500 KOHM (B)
R304	1	NN05333810	33 KOHM +- 5 % 1/16 W
R305	1	NN05104810	100 KOHM +- 5 % 1/16 W
R306	1	NN05471810	470 OHM +- 5 % 1/16 W
R307	1	NN05224810	220 KOHM +- 5 % 1/16 W
R308	1	NN05473810	47 KOHM +- 5 % 1/16 W
R309	1	NN05473810	47 KOHM +- 5 % 1/16 W
R310	1	NN05473810	47 KOHM +- 5 % 1/16 W
R311	1	NN05473810	47 KOHM +- 5 % 1/16 W
R312	1	NN05101810	100 OHM +- 5 % 1/16 W
R313	1	NN05473810	47 KOHM +- 5 % 1/16 W
R314	1	NN05473810	47 KOHM +- 5 % 1/16 W
R315	1	NN05473810	47 KOHM +- 5 % 1/16 W
R316	1	NN05473810	47 KOHM +- 5 % 1/16 W
R317	1	NN05473810	47 KOHM +- 5 % 1/16 W
R318	1	NN05473810	47 KOHM +- 5 % 1/16 W
R319	1	NN05473810	47 KOHM +- 5 % 1/16 W
R320	1	NN05224810	220 KOHM +- 5 % 1/16 W
R321	1	NN05473810	47 KOHM +- 5 % 1/16 W
R322	1	NN05103810	10 KOHM +- 5 % 1/16 W
R323	1	NN05684810	680 KOHM +- 5 % 1/16 W
R325	1	NN05473810	47 KOHM +- 5 % 1/16 W
R326	1	NN05000810	0 OHM 1/16 W
R327	1	NN05000810	0 OHM 1/16 W
R331	1	NN05000810	0 OHM 1/16 W
R332	1	NN05103810	10 KOHM +- 5 % 1/16 W
S203	1	SP01011200	FUNCTION BUTTON
S204	1	SP0101131R	PTT BUTTON
X201	1	JX3000131R	CRYSTAL RESONATOR 23.505 MHZ
X202	1	FQ0400402R	CERAMIC RESONATOR 4.00 MHZ
X203	1	FQ0358404R	CERAMIC RESONATOR 3.58 MHZ

REF. DESIG.	QTY	PART NO.	DESCRIPTION
<b>PA02 SQUELCHI CONTROL P.C.BOARD</b>			
<b>PA02</b>	1	<b>WX123X2840</b>	<b>SQUELCHI CONTROL P.C.BOARD</b>
C210	1	DD95221300	220 PF +- 5 % CH
C211	1	DD95221300	220 PF +- 5 % CH
C212	1	DD95221300	220 PF +- 5 % CH
C213	1	DK96332300	0.0033 UF +- 10 %
R215	1	NN05102810	1 KOHM +- 5 % 1/16 W
R216	1	RK0103103R	VARIABLE RESISTOR 10 KOHM(B)
R217	1	NN05102810	1 KOHM +- 5 % 1/16 W
R218	1	NN05223810	22 KOHM +- 5 % 1/16 W
<b>PA03 VOLUME CONTROL P.C.BOARD</b>			
<b>PA03</b>	1	<b>WX123X2830</b>	<b>VOLUME CONTROL P.C.BOARD</b>
C232	1	DK5668320R	0.068 UF +- 10 %
C233	1	DK58473200	0.047 UF +- 10 %
Q215	1	HY101441AR	FET 2S144(Y)
R227	1	NN05472810	4.7 KOHM +- 5 % 1/16 W
R236	1	NN05101810	1 KOHM +- 5 % 1/16 W
R237	1	RK1103030R	VARIABLE RESISTOR 10 KOHM(A)
R238	1	NN05473810	47 KOHM +- 5 % 1/16 W
<b>PA04 ADJUST P.C.BOARD</b>			
<b>PA04</b>	1	<b>WX123X2860</b>	<b>ADJUST P.C.BOARD</b>
R228	1	NY05040050	TRIMMING RESISTOR 500 KOHM (B)
R229	1	NY02030050	TRIMMING RESISTOR 20 KOHM (B)
R230	1	NY05030050	TRIMMING RESISTOR 50 KOHM (B)
<b>PC01 ROTARY CHANNEL ENCODER P.C.BOARD</b>			
<b>PC01</b>	1	<b>WX123X2850</b>	<b>ROTARY CHANNEL ENCODER P.C.BOARD</b>
C751	1	DK96102300	0.001 UF +- 10 %
C752	1	DK96102300	0.001 UF +- 10 %
S751	1	SR0120007R	ROTARY CHANNEL ENCODER
W751	1	YB0005077R	3 PIN CORD WITH PC01
<b>PC02 DISPLAY SWITCH P.C.BOARD</b>			
<b>PC02</b>	1	<b>WX123X2880</b>	<b>DISPLAY SWITCH P.C.BOARD</b>
S202	1	SP01011300	CALL BUTTON

REF. DESIG.	QTY	PART NO.	DESCRIPTION		
			<b>PL01 DISPLAY P.C.BOARD</b>		
<b>PL01</b>	<b>1</b>	<b>WX123X0010</b>	<b>DISPLAY P.C.BOARD</b>		
C101	1	DK96102300	0.001 UF	+ - 10 %	
C102	1	DK96102300	0.001 UF	+ - 10 %	
C104	1	DD95390300	39 PF	+ - 5 %	CH
C105	1	DD95390300	39 PF	+ - 5 %	CH
C106	1	DK5668320R	0.068 UF	+ - 10 %	
C107	1	DK96102300	0.001 UF	+ - 10 %	
C109	1	DK96223200	0.022 UF	+ - 10 %	
C110	1	DK96223200	0.022 UF	+ - 10 %	
C111	1	DK96223200	0.022 UF	+ - 10 %	
C112	1	DK96103200	0.01 UF	+ - 10 %	
C113	1	DK96223200	0.022 UF	+ - 10 %	
C114	1	DK96102300	0.001 UF	+ - 10 %	
C115	1	DK96102300	0.001 UF	+ - 10 %	
C116	1	DK96102300	0.001 UF	+ - 10 %	
C117	1	DK96102300	0.001 UF	+ - 10 %	
E101	1	QK00368060	INTERNAL SPEAKER 8 OHM		
N101	1	MS5000028R	E.C.M		
Q101	1	HC1020806R	MICROPROCESSOR UPD7225GB		
Q102	1	KZ0310532R	LCD KIT LF7663M		
Q103	1	HC10253050	IC TC35310F		
Q104	1	HZ2002602R	DIODE MA111		
Q105	1	HZ2003405R	DIODE HN2D01F		
Q106	1	HZ2002602R	DIODE MA111		
Q107	1	HZ2002602R	DIODE MA132WK		
R101	1	NN05103610	10 KOHM	+ - 5 %	1/16 W
R102	1	NN05103610	10 KOHM	+ - 5 %	1/16 W
R103	1	NN05473610	47 KOHM	+ - 5 %	1/16 W
R105	1	NN05103610	10 KOHM	+ - 5 %	1/16 W
R106	1	NN05103610	10 KOHM	+ - 5 %	1/16 W
R107	1	NN05103610	10 KOHM	+ - 5 %	1/16 W
R108	1	NN05103610	10 KOHM	+ - 5 %	1/16 W
R109	1	NN05103610	10 KOHM	+ - 5 %	1/16 W
R110	1	NN05224610	220 KOHM	+ - 5 %	1/16 W
R111	1	NN05224610	220 KOHM	+ - 5 %	1/16 W
R112	1	NN05104610	100 KOHM	+ - 5 %	1/16 W
R113	1	NN05104610	100 KOHM	+ - 5 %	1/16 W
R114	1	NN05102610	1 KOHM	+ - 5 %	1/16 W
R115	1	NN05102610	1 KOHM	+ - 5 %	1/16 W
R116	1	NN05102610	1 KOHM	+ - 5 %	1/16 W
R117	1	NN05102610	1 KOHM	+ - 5 %	1/16 W
R118	1	NN05224610	220 KOHM	+ - 5 %	1/16 W
R119	1	NN05103610	10 KOHM	+ - 5 %	1/16 W
R120	1	NN05103610	10 KOHM	+ - 5 %	1/16 W
R121	1	NN05103610	10 KOHM	+ - 5 %	1/16 W
R122	1	NN05223610	22 KOHM	+ - 5 %	1/16 W
R123	1	NN05104610	100 KOHM	+ - 5 %	1/16 W
R124	1	NN0533610	33 KOHM	+ - 5 %	1/16 W
R125	1	NN05103610	10 KOHM	+ - 5 %	1/16 W
R126	1	NN05103610	10 KOHM	+ - 5 %	1/16 W
R127	1	NN05103610	10 KOHM	+ - 5 %	1/16 W
R128	1	NN05103610	10 KOHM	+ - 5 %	1/16 W
V101	1	IN1005013R	LAMP 5 V/115 MA		
W101	1	WE124X0010	24 LINES FLEXIBLE P.C.BOARD		
X101	1	FQ0358404R	CERAMIC RESONATOR 3.58 MHZ		

REF. DESIG.	QTY	PART NO.	DESCRIPTION		
			<b>PM01 ROM P.C.BOARD</b>		
<b>PM01</b>	<b>1</b>	<b>WZ153X0010</b>	<b>ROM P.C.BOARD</b>		
Q701	1	HC1000670R	IC X24LC04S		
R701	1	NN05473610	47 KOHM	+ - 5 %	1/16 W
R702	1	NN05473610	47 KOHM	+ - 5 %	1/16 W
R703	1	NN05473610	47 KOHM	+ - 5 %	1/16 W
			<b>PR01 RF P.C.BOARD</b>		
<b>PR01</b>	<b>1</b>	<b>WZ123X2220</b>	<b>RF P.C.BOARD</b>		
C402	1	DD91060300	6 PF	+ - 0.5 PF	CH
C404	1	DD95270300	27 PF	+ - 5 %	CH
C405	1	DD95180300	18 PF	+ - 5 %	CH
C406	1	DK96102300	0.001 UF	+ - 10 %	
C407	1	DD95180300	18 PF	+ - 5 %	CH
C408	1	DD95220300	22 PF	+ - 5 %	CH
C409	1	DK96102300	0.001 UF	+ - 10 %	
C410	1	DD95330300	33 PF	+ - 5 %	CH
C411	1	DK96102300	0.001 UF	+ - 10 %	
C412	1	DD91070300	7 PF	+ - 0.5 PF	CH
C413	1	DD91070300	7 PF	+ - 0.5 PF	CH
C414	1		16 PF	+ - 5 %	CH
C414	1		14 PF	+ - 5 %	CH
C415	1	DD95330300	33 PF	+ - 5 %	CH
C416	1	DD90050300	5 PF	+ - 0.25 PF	CH
C417	1	DD95180300	18 PF	+ - 5 %	CH
C418	1	DD91060300	6 PF	+ - 0.5 PF	CH
C419	1	DK96102300	0.001 UF	+ - 10 %	
C420	1	DD90050300	5 PF	+ - 0.25 PF	CH
C421	1	DK96102300	0.001 UF	+ - 10 %	
C422	1	DK96102300	0.001 UF	+ - 10 %	
C423	1	DK96102300	0.001 UF	+ - 10 %	
C424	1	DD91100300	10 PF	+ - 0.5 PF	CH
C425	1	DK96102300	0.001 UF	+ - 10 %	
C426	1	DD90020300	2 PF	+ - 0.25 PF	CK
C427	1	DK96102300	0.001 UF	+ - 10 %	
C428	1	DK96102300	0.001 UF	+ - 10 %	
C429	1	DD91100300	10 PF	+ - 0.5 PF	CH
C430	1	DK96102300	0.001 UF	+ - 10 %	
C431	1	DD90020300	2 PF	+ - 0.25 PF	CK
C432	1	DK96102300	0.001 UF	+ - 10 %	
C433	1	DK96102300	0.001 UF	+ - 10 %	
C434	1	DK96102300	0.001 UF	+ - 10 %	
C435	1	DD95560300	56 PF	+ - 5 %	CH
C436	1	DK96103200	0.01 UF	+ - 10 %	
C437	1	DD95180300	18 PF	+ - 5 %	CH
C438	1	DD91070300	7 PF	+ - 0.5 PF	CH
C439	1	DK96103200	0.01 UF	+ - 10 %	
C440	1	DK96103200	0.01 UF	+ - 10 %	
C441	1	DD95101300	100 PF	+ - 5 %	CH
C442	1	DD95220300	22 PF	+ - 5 %	CH
C443	1	DK96102300	0.001 UF	+ - 10 %	
C444	1	DD91100300	10 PF	+ - 0.5 PF	CH
C445	1	DK96102300	0.001 UF	+ - 10 %	
C446	1	DK96102300	0.001 UF	+ - 10 %	
C447	1	DD91100300	10 PF	+ - 0.5 PF	CH
C448	1	DD90050300	5 PF	+ - 0.25 PF	CH
C449	1	DK96102300	0.001 UF	+ - 10 %	

[A]  
[B]

REF. DESIG.	QTY	PART NO.	DESCRIPTION
<b>PR01 RF P.C.BOARD</b>			
C450	1	DK96102300	0.001 UF +- 10 %
C452	1	DD95220300	22 PF +- 5 % CH
C454	1	DK96102300	0.001 UF +- 10 %
C455	1	EJ10605010	ELECT CAP 10 UF/50 V
C456	1	DK96102300	0.001 UF +- 10 %
C457	1	DD90020300	2 PF +- 0.25 PF CK
C458	1	DK96102300	0.001 UF +- 10 %
C459	1	DD95180300	18 PF +- 5 % CH
C460	1	DD95180300	18 PF +- 5 % CH
C461	1	DD90010300	1 PF +- 0.25 PF CK
C462	1	DD90050300	5 PF +- 0.25 PF CH
C463	1	DK96102300	0.001 UF +- 10 %
C464	1	DK96102300	0.001 UF +- 10 %
C465	1	DD95270360	27 PF +- 5 % UJ
C466	1	DD95330300	33 PF +- 5 % CH
C467	1	CX11000030	TRIMMING CAP 10 PF
C468	1	DK46104200	0.1 UF +- 10 %
C469	1	DK96102300	0.001 UF +- 10 %
C470	1	KC097X001R	TANTAL CAP 4.7 UF/6.3 V
C471	1	DK96103200	0.01 UF +- 10 %
C472	1	KC097X002R	TANTAL CAP 10 UF/6.3 V
C473	1	DK56473200	0.047 UF +- 10 %
C474	1	DK5815420R	0.15 UF +80 %, -20 %
C475	1	DD95470300	47 PF +- 5 % CH
C476	1	DK96102300	0.001 UF +- 10 %
C477	1	DK96102300	0.001 UF +- 10 %
C478	1	DK56102300	0.001 UF +- 10 %
C479	1	DK96102300	0.001 UF +- 10 %
C480	1	DK96102300	0.001 UF +- 10 %
C481	1	DK96102300	0.001 UF +- 10 %
C482	1	DK96102300	0.001 UF +- 10 %
C483	1	DK96102300	0.001 UF +- 10 %
C485	1	DK96102300	0.001 UF +- 10 %
C487	1	DD9547036R	47 PF +- 5 % UJ
C488	1	DK96102300	0.001 UF +- 10 %
C489	1	DK96102300	0.001 UF +- 10 %
C490	1	DK96102300	0.001 UF +- 10 %
C491	1	DK96102300	0.001 UF +- 10 %
C492	1	DK96102300	0.001 UF +- 10 %
C494	1	DK96223200	0.022 UF +- 10 %
F401	1	XU830850MR	CRYSTAL FILTER 30.85 MHZ
J401	1	YJ01002400	EXTERNAL MICROPHONE JACK 2.5 MM
J402	1	YJ01001840	EXTERNAL SPEAKER JACK 3.5 MM
J403	1	YJ10002220	ANTENNA CONNECTOR (BNC)
L401	1	ML030050HR	AIR COIL 3.0 MM 2.5 T
L402	1	ML030050JR	AIR COIL 3.0 MM 3.5 T
L403	1	ML030050KR	AIR COIL 3.0 MM 4.5 T
L404	1	ML030050GR	AIR COIL 3.0 MM 1.5 T
L405	1	LA5501812R	ANTENNA COIL
L406	1	LA5501813R	ANTENNA COIL
L407	1	LA5501813R	ANTENNA COIL
L408	1	LA5501814R	ANTENNA COIL
L409	1	LA5012603R	ANTENNA COIL

REF. DESIG.	QTY	PART NO.	DESCRIPTION
<b>PR01 RF P.C.BOARD</b>			
L410	1	LA5012604R	ANTENNA COIL
L411	1	LU1122101R	CHIP INDUCTOR 0.22 UH
L412	1	ML030050KR	AIR COIL 3.0 MM 4.5 T
L413	1	ML030050JR	AIR COIL 3.0 MM 3.5 T
L414	1	LC1102017R	CHOKO COIL 1 UH
L415	1	KL102X002R	CHIP INDUCTOR 1 UH
L416	1	LU21220010	CHIP INDUCTOR 0.22 UH
L417	1	LU2110101R	CHIP INDUCTOR
Q401	1	HZ2002602R	DIODE MA111
Q402	1	BA20035210	DIGITAL TRANSISTOR DTC144EU
Q403	1	HZ2001721R	DIODE RLS135
Q404	1	HZ2001721R	DIODE RLS135
Q406	1	BA2003121R	DIGITAL TRANSISTOR FMW1
Q407	1	HZ20029050	DIODE 1SS314
Q408	1	HY203021BR	FET 2SK302(Y2)
Q409	1	HX341541AR	TRANSISTOR 2SC4154F
Q410	1	HZ20029050	DIODE 1SS314
Q411	1	HZ20029050	DIODE 1SS314
Q412	1	HZ2003305R	DIODE 1SS312
Q413	1	HY203021AR	FET 2SK302(Y1)
Q414	1	BA20035210	DIGITAL TRANSISTOR DTC144EU
Q415	1	HY208821AR	FET 2SK882(Y)
Q416	1	HZ2003305R	DIODE 1SS312
Q417	1	HZ2003305R	DIODE 1SS312
Q418	1	HZ2003305R	DIODE 1SS312
Q419	1	HX342151AR	TRANSISTOR 2SC4125(Y)
Q420	1	HX341541AR	TRANSISTOR 2SC4154F
Q421	1	HX33356010	TRANSISTOR 2SC3356(R24)
Q422	1	HC1013020R	IC M67748L
Q423	1	HZ2002705R	DIODE 1SS239
Q424	1	HC1004618R	IC MB1504LPF - G - BND
Q425	1	HZ20018050	DIODE 1SS302
R401	1	NN05103610	10 KOHM +- 5 % 1/16 W
R402	1	NN05104610	100 KOHM +- 5 % 1/16 W
R404	1	NN05223610	22 KOHM +- 5 % 1/16 W
R405	1	NN05473610	47 KOHM +- 5 % 1/16 W
R406	1	NN05223610	22 KOHM +- 5 % 1/16 W
R407	1	NN05223610	22 KOHM +- 5 % 1/16 W
R408	1	NN05470610	47 OHM +- 5 % 1/16 W
R409	1	NN05101610	100 OHM +- 5 % 1/16 W
R410	1	NN05472610	4.7 KOHM +- 5 % 1/16 W
R411	1	NN05473610	47 KOHM +- 5 % 1/16 W
R412	1	NN05223610	22 KOHM +- 5 % 1/16 W
R413	1	NN05223610	22 KOHM +- 5 % 1/16 W
R414	1	NN05101610	100 OHM +- 5 % 1/16 W
R415	1	NN05473110	47 KOHM +- 5 % 1/10 W
R416	1	NN05223610	22 KOHM +- 5 % 1/16 W
R417	1	NN05223610	22 KOHM +- 5 % 1/16 W
R418	1	NN05103110	10 KOHM +- 5 % 1/10 W
R419	1	NN05472610	4.7 KOHM +- 5 % 1/16 W

REF. DESIG.	QTY	PART NO.	DESCRIPTION		
<b>PR01 RF P.C.BOARD</b>					
R420	1	NN05101810	100 OHM	+ - 5 %	1/16 W
R421	1	NN05152810	1.5 KOHM	+ - 5 %	1/16 W
R422	1	NN05332810	3.3 KOHM	+ - 5 %	1/16 W
R423	1	NI05470110	47 OHM	+ - 5 %	1/10W
R424	1	NN05102810	1 KOHM	+ - 5 %	1/16 W
R425	1	NN05474810	470 KOHM	+ - 5 %	1/16 W
R426	1	NN05104810	100 KOHM	+ - 5 %	1/16 W
R427	1	NN05101810	100 OHM	+ - 5 %	1/16 W
R428	1	NN05472810	4.7 KOHM	+ - 5 %	1/16 W
R430	1	NN05101810	100 OHM	+ - 5 %	1/16 W
R431	1	NN05470810	47 OHM	+ - 5 %	1/16 W
R432	1	NN05223810	22 KOHM	+ - 5 %	1/16 W
R433	1	NN05104810	100 KOHM	+ - 5 %	1/16 W
R434	1	NN05103810	10 KOHM	+ - 5 %	1/16 W
R435	1	NN05223810	22 KOHM	+ - 5 %	1/16 W
R436	1	NN05223810	22 KOHM	+ - 5 %	1/16 W
R437	1	NI05223110	22 KOHM	+ - 5 %	1/10 W
R438	1	NN05103810	10 KOHM	+ - 5 %	1/16 W
R439	1	NN05472810	4.7 KOHM	+ - 5 %	1/16 W
R440	1	NN05471810	470 OHM	+ - 5 %	1/16 W
R441	1	NN05101810	100 OHM	+ - 5 %	1/16 W
R442	1	NN05333810	33 KOHM	+ - 5 %	1/16 W
R443	1	NN05101810	100 OHM	+ - 5 %	1/16 W
R444	1	NI05103110	10 KOHM	+ - 5 %	1/10 W
R445	1	NN05100810	10 OHM	+ - 5 %	1/16 W
R446	1	NN05101810	100 OHM	+ - 5 %	1/16 W
R447	1	NN05101810	100 OHM	+ - 5 %	1/16 W
R448	1	NN05150810	15 OHM	+ - 5 %	1/16 W
R449	1	NN05101810	100 OHM	+ - 5 %	1/16 W
R450	1	NN05471810	470 OHM	+ - 5 %	1/16 W
R451	1	NN05821810	820 OHM	+ - 5 %	1/16 W
R452	1	NN05153810	15 KOHM	+ - 5 %	1/16 W
R453	1	NN05222810	2.2 KOHM	+ - 5 %	1/16 W
R454	1	NN05474810	470 KOHM	+ - 5 %	1/16 W
R458	1	NN05103810	10 KOHM	+ - 5 %	1/16 W
R457	1	NN05105810	1M OHM	+ - 5 %	1/16 W
R458	1	NI05000110	0 OHM		1/10 W
R459	1	NN05103810	10 KOHM	+ - 5 %	1/16 W
R460	1	NI05333110	33 KOHM	+ - 5 %	1/10 W
R461	1	NN05103810	10 KOHM	+ - 5 %	1/16 W
R462	1	NN05333810	33 KOHM	+ - 5 %	1/16 W
R463	1	NN05103810	10 KOHM	+ - 5 %	1/16 W
R464	1	NN05333810	33 KOHM	+ - 5 %	1/16 W
R465	1	NN05101810	100 OHM	+ - 5 %	1/16 W
R467	1	NN05223810	22 KOHM	+ - 5 %	1/16 W
R468	1	NN05223810	22 KOHM	+ - 5 %	1/16 W
R469	1	NN05104810	100 KOHM	+ - 5 %	1/16 W
R470	1	NI05000110	0 OHM		1/10 W
R471	1	NI05000110	0 OHM		1/10 W
R472	1	NN05000810	0 OHM		1/16 W
W401	1	YB0005080R	7 PIN CORD WITH PR01		
W402	1	YB0005076R	15 PIN CORD WITH PR01		
X401	1	JX1200131R	CRYSTAL RESONATOR 12.8 MHZ		

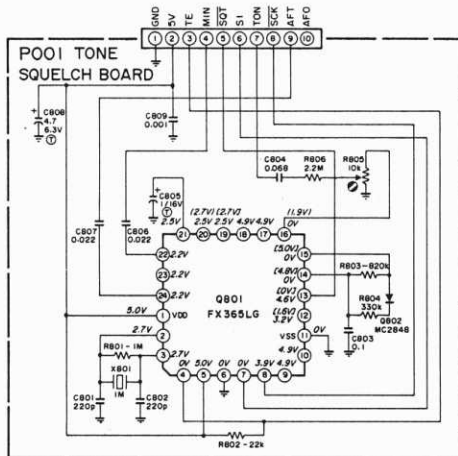
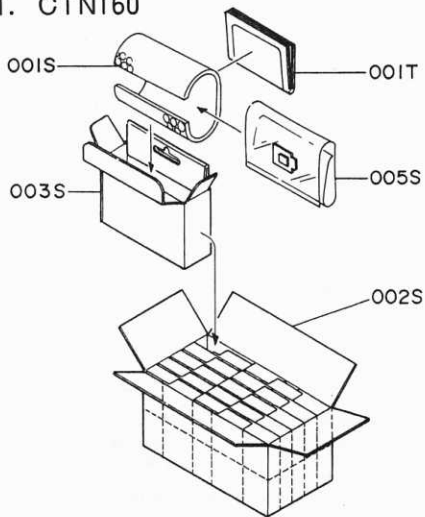
REF. DESIG.	QTY	PART NO.	DESCRIPTION		
<b>PR02 SUB P.C.BOARD</b>					
PR02	1	WX123X2820	SUB P.C.BOARD		
C578	1	DD90020300	2 PF	+ - 0.25 PF	CK
C579	1	DD90015300	1.5 PF	+ - 0.25 PF	CK
C580	1	DK98102300	0.001 UF	+ - 10 %	
C581	1	DD91060300	6 PF	+ - 0.5 PF	CH
C582	1	DD95150300	15 PF	+ - 5 %	CH
C583	1	DD95150300	15 PF	+ - 5 %	CH
C584	1	DK98102300	0.001 UF	+ - 10 %	
C585	1	DD95220300	22 PF	+ - 5 %	CH
C586	1	DD95220300	22 PF	+ - 5 %	CH
C587	1	DD90020300	2 PF	+ - 0.25 PF	CK
C588	1	DD95220300	22 PF	+ - 5 %	CH
C589	1	DD95220300	22 PF	+ - 5 %	CH
L581	1	ML030050GR	AIR COIL 3.0 MM 1.5 T		
Q581	1	HZ20029050	DIODE 1SS314		
Q582	1	HX3439300R	TRANSISTOR 2SC4393		
Q583	1	HX3424500R	TRANSISTOR 2SC4245		
R581	1	NN05223810	22 KOHM	+ - 5 %	1/16 W
R582	1	NN05103810	10 KOHM	+ - 5 %	1/16 W
R583	1	NN05472810	4.7 KOHM	+ - 5 %	1/16 W
R584	1	NN05221810	220 OHM	+ - 5 %	1/16 W
R585	1	NN05331810	330 OHM	+ - 5 %	1/16 W
R586	1	NN05224810	220 KOHM	+ - 5 %	1/16 W
<b>PR03 APC P.C.BOARD</b>					
PR03	1	WX123X2870	APC P.C.BOARD		
C590	1	DK98102300	0.001 UF	+ - 10 %	
C591	1	DK98102300	0.001 UF	+ - 10 %	
C592	1	KC097X001R	TANTAL CAP 4.7 UF/8.3 V		
L590	1	FC9002003R	FERRITE CORE BLM21A05PT		
Q590	1	HZ3001105R	ZENER DIODE 02CZ2.4X		
Q591	1	HC1005809R	IC NJM2904E		
Q592	1	HX341541AR	TRANSISTOR 2SC4154F		
Q593	1	BA20035210	DIGITAL TRANSISTOR DTC144UE		
R589	1	NN05472810	4.7 KOHM	+ - 5 %	1/16 W
R590	1	NN05103810	10 KOHM	+ - 5 %	1/16 W
R591	1	NN05102810	1 KOHM	+ - 5 %	1/16 W
R592	1	NN05104810	100 KOHM	+ - 5 %	1/16 W
R593	1	NN05822810	8.2 KOHM	+ - 5 %	1/16 W
R594	1	NN05183810	18 KOHM	+ - 5 %	1/16 W
R595	1	NN05472810	4.7 KOHM	+ - 5 %	1/16 W
R596	1	NN05103810	10 KOHM	+ - 5 %	1/16 W
R597	1	NN05103810	10 KOHM	+ - 5 %	1/16 W
R598	1	NN05100810	10 OHM	+ - 5 %	1/16 W
R599	1	HH5000100R	THERMISTOR NT732A104K		

REF. DESIG.	QTY	PART NO.	DESCRIPTION
<b>PV01 VCO P.C.BOARD</b>			
PV01	1	WX123X2810	VCO P.C.BOARD
C551	1	DK98102300	0.001 UF + - 10 %
C552	1	DK98102300	0.001 UF + - 10 %
C553	1	DK98102300	0.001 UF + - 10 %
C554	1	DD91080360	8 PF + - 0.5 PF UJ
C555	1	DK98102300	0.001 UF + - 10 %
C556	1	DD9004036R	4 PF + - 0.25 PF UJ
C557	1	DK98102300	0.001 UF + - 10 %
C558	1	DD90030360	3 PF + - 0.25 PF UJ
C559	1	DD9001036R	1 PF + - 0.25 PF UJ
C560	1	DK98102300	0.001 UF + - 10 %
C561	1	DD90050360	5 PF + - 0.25 PF UJ
C562	1	DD9001036R	1 PF + - 0.25 PF UJ
C563	1	DK98102300	0.001 UF + - 10 %
C564	1	DD9004036R	4 PF + - 0.25 PF UJ
C565	1	DK98102300	0.001 UF + - 10 %
C566	1	DD9002036R	2 PF + - 0.25 PF UJ
C567	1	DD90030360	3 PF + - 0.25 PF CJ
C568	1	DK98102300	0.001 UF + - 10 %
C569	1	DK98102300	0.001 UF + - 10 %
C570	1	DK98102300	0.001 UF + - 10 %
C571	1	DK98102300	0.001 UF + - 10 %
C572	1	DK98102300	0.001 UF + - 10 %
L551	1	ML0250302R	AIR COIL 7.5 T
L552	1	LU1122201R	CHIP INDUCTOR 2.2 UH
L553	1	LU1122101R	CHIP INDUCTOR 0.22 UH
L554	1	ML030050KR	AIR COIL 3.0 MM 4.5 T
L555	1	LU1122201R	CHIP INDUCTOR 2.2 UH
L556	1	LU1122101R	CHIP INDUCTOR 0.22 UH
L557	1	ML030050GR	AIR COIL 3.0 MM 1.5 T
Q551	1	HZ4001405R	VARACTOR 1SV217
Q552	1	HZ4001405R	VARACTOR 1SV217
Q553	1	HZ20029050	DIODE 1SS314
Q554	1	HY208811YR	FET 2SK881(Y)
Q555	1	HX3424500R	TRANSISTOR 2SC4245
Q556	1	HZ20029050	DIODE 1SS314
Q557	1	HZ4001305R	VARACTOR 1SV215
Q558	1	HZ4001305R	VARACTOR 1SV215
Q559	1	HZ40010050	VARACTOR 1SV214
Q560	1	HY202101YR	FET 2SK210(Y2)
Q561	1	HX3424500R	TRANSISTOR 2SC4245
Q562	1	HZ20029050	DIODE 1SS314
Q563	1	HZ20029050	DIODE 1SS314
Q564	1	HZ4001405R	VARACTOR 1SV217
Q565	1	HZ4001405R	VARACTOR 1SV217
R551	1	NN05222610	2.2 KOHM + - 5 % 1/16 W
R552	1	NN05222610	2.2 KOHM + - 5 % 1/16 W
R553	1	NN05103610	10 KOHM + - 5 % 1/16 W
R554	1	NN05103610	10 KOHM + - 5 % 1/16 W
R555	1	NN05100610	10 OHM + - 5 % 1/16 W
R556	1	NN05100610	10 OHM + - 5 % 1/16 W
R557	1	NN05561610	580 OHM + - 5 % 1/16 W
R558	1	NN05103610	10 KOHM + - 5 % 1/16 W
R559	1	NN05472610	4.7 KOHM + - 5 % 1/16 W

REF. DESIG.	QTY	PART NO.	DESCRIPTION
<b>PV01 VCO P.C.BOARD</b>			
R560	1	NN05223610	22 KOHM + - 5 % 1/16 W
R561	1	NN05222610	2.2 KOHM + - 5 % 1/16 W
R562	1	NN05103610	10 KOHM + - 5 % 1/16 W
R563	1	NN05100610	10 OHM + - 5 % 1/16 W
R564	1	NN05100610	10 OHM + - 5 % 1/16 W
R565	1	NN05101610	100 OHM + - 5 % 1/16 W
R566	1	NN05223610	22 KOHM + - 5 % 1/16 W
R567	1	NN05103610	10 KOHM + - 5 % 1/16 W
R568	1	NN05472610	4.7 KOHM + - 5 % 1/16 W
R569	1	NN05473610	4.7 KOHM + - 5 % 1/16 W
R570	1	NN05223610	22 KOHM + - 5 % 1/16 W
R571	1	NN05223610	22 KOHM + - 5 % 1/16 W
R572	1	NN05223610	22 KOHM + - 5 % 1/16 W
<b>P001 TONE SQUELCH BOARD</b>			
P001	1	WZ143X0310	TONE SQUELCH BOARD
C801	1	DD95221300	220 PF + - 5 % CH
C802	1	DD95221300	220 PF + - 5 % CH
C803	1	DK56104200	0.1 UF + - 10 %
C804	1	DK56683200	0.068 UF + - 10 %
C805	1	EY10501610	TANTAL CAP 1 UF/16 V
C806	1	DK98223200	0.022 UF + - 10 %
C807	1	DK98223200	0.022 UF + - 10 %
C808	1	KC097X001R	TANTAL CAP 4.7 UF/8.3V
C809	1	DK98102300	0.001 UF + - 10 %
Q801	1	HC10012510	IC FX365LG
Q802	1	HZ2000420R	DIODE MC2848
R801	1	NN05105610	1 MOHM + - 5 % 1/16 W
R802	1	NN05223610	22 KOHM + - 5 % 1/16 W
R803	1	NN05824610	820 KOHM + - 5 % 1/16 W
R804	1	NN05334610	330 KOHM + - 5 % 1/16 W
R805	1	NY01030050	TRIMMING RESISTOR 10 KOHM
R806	1	NN05225610	2.2 MOHM + - 5 % 1/16 W
X801	1	FQ01004020	CERAMIC RESONATOR 1 MHZ

# 7. SCHEMATIC DIAGRAM/COMPONENT OVERLAY/PACKING/ PARTS LIST (OPTIONS)

## 7.1. CTN160



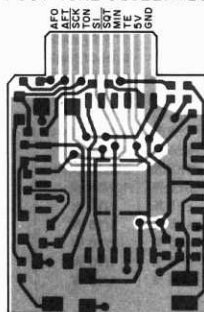
- NOTES:
1. REFER TO PARTS LIST FOR COMPONENT VALUES
  2. UNLESS OTHERWISE NOTED RESISTOR VALUES ARE IN OHMS, AND CAPACITOR VALUES ARE IN MICROFARADS.
  3. VOLTAGE NOTATIONS ARE AS FOLLOWS:  
 THE VOLTAGE VALUES WITHOUT CONDITIONS OF ENCODE OR DECODE ARE COMMON FOR THE CONDITION OF DECODE, ENCODE AND STANDBY.  
 NO MARKING — STANDBY  
 ( ) — ENCODE  
 [ ] — DECODE

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REF. DESIG.	QTY	PART NO.	DESCRIPTION
<b>TONE SQUELCH BOARD : CTN160</b>			
<b>PACKING</b>			
001S	1	083X809010	CUSHION
002S	1	143X805010	MASTER CARTON
003S	1	143X801010	PACKING CASE
004S	1	158C861020	LABEL
005S	1	143X811010	POLYETHYLENE BAG
001T	1	143X851210	INST
<b>P001 TONE SQUELCH BOARD</b>			
P001	1	WZ143X0310	<b>TONE SQUELCH BOARD</b>
C801	1	DD95221300	220 PF +- 5 % CH
C802	1	DD95221300	220 PF +- 5 % CH
C803	1	DK56104200	0.1 UF +- 10 %
C804	1	DK56883200	0.088 UF +- 10 %
C805	1	EY10501810	TANTAL CAP 0.1 UF/16 V
C806	1	DK96223200	0.022 UF +- 10 %
C807	1	DK96223200	0.022 UF +- 10 %
C808	1	KC097X001R	TANTAL CAP 4.7 UF
C809	1	DK96102300	0.001 UF +- 10 %
Q801	1	HC10012510	IC FX365LG
Q802	1	HZ2000420R	DIODE MC2848
R801	1	NN05105610	1 MOHM +- 5 % 1/16 W
R802	1	NN05223610	22 KOHM +- 5 % 1/16 W
R803	1	NN05824610	820 KOHM +- 5 % 1/16 W
R804	1	NN05334610	330 KOHM +- 5 % 1/16 W
R805	1	NY01030050	TRIMMING RESISTOR 10 KOHM
R806	1	NN05225610	2.2 MOHM +- 5 % 1/16 W
X801	1	FQ01004020	CERAMIC RESONATOR 1 MHZ

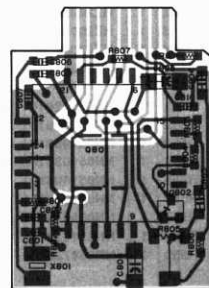
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P001 TONE SQUELCH BOARD



(SOLDER SIDE)

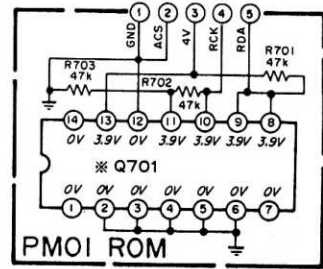
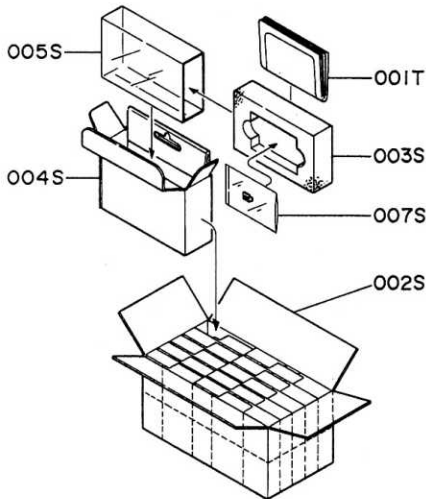
P001 TONE SQUELCH BOARD



(PARTS SIDE)

P Δ <0003>

## 7.2. CMU160/CMU161



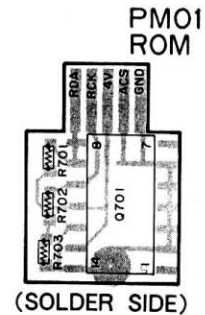
S△ <0003>

\* Q701-X24LC04S.....CMU160  
Q701-X24LC16S.....CMU161

CMU160 : [A] / CMU161 : [B]

REF. DESIG.	QTY	PART NO.	DESCRIPTION
<b>MEMORY UNIT: CMU160/CMU161</b>			
<b>PACKING</b>			
001S	1	153X881010	LABEL [A]
001S	1	154X881010	LABEL [B]
002S	1	153X805010	MASTER CARTON [A]
002S	1	154X805010	MASTER CARTON [B]
003S	1	153X809010	CUSHION
004S	1	153X802010	PACKING CASE [A]
004S	1	154X802010	PACKING CASE [B]
005S	1	153X804010	SLEEVE
006S	1	159C861020	LABEL FOR CMU160
007S	1	153X811010	POLYETHYLENE BAG
001T	1	153X851010	INST FOR CMU160 /CMU161
<b>P001 ROM P.C.BOARD</b>			
P001	1	WZ153X0010	ROM P.C.BOARD
Q701	1	HC1000670R	IC X24LC04S [A]
Q701	1	HC1000770R	IC X24LC16S [B]
R701	1	NN05473810	47 KOHM +-5 % 1/16 W
R702	1	NN05473810	47 KOHM +-5 % 1/16 W
R703	1	NN05473810	47 KOHM +-5 % 1/16 W

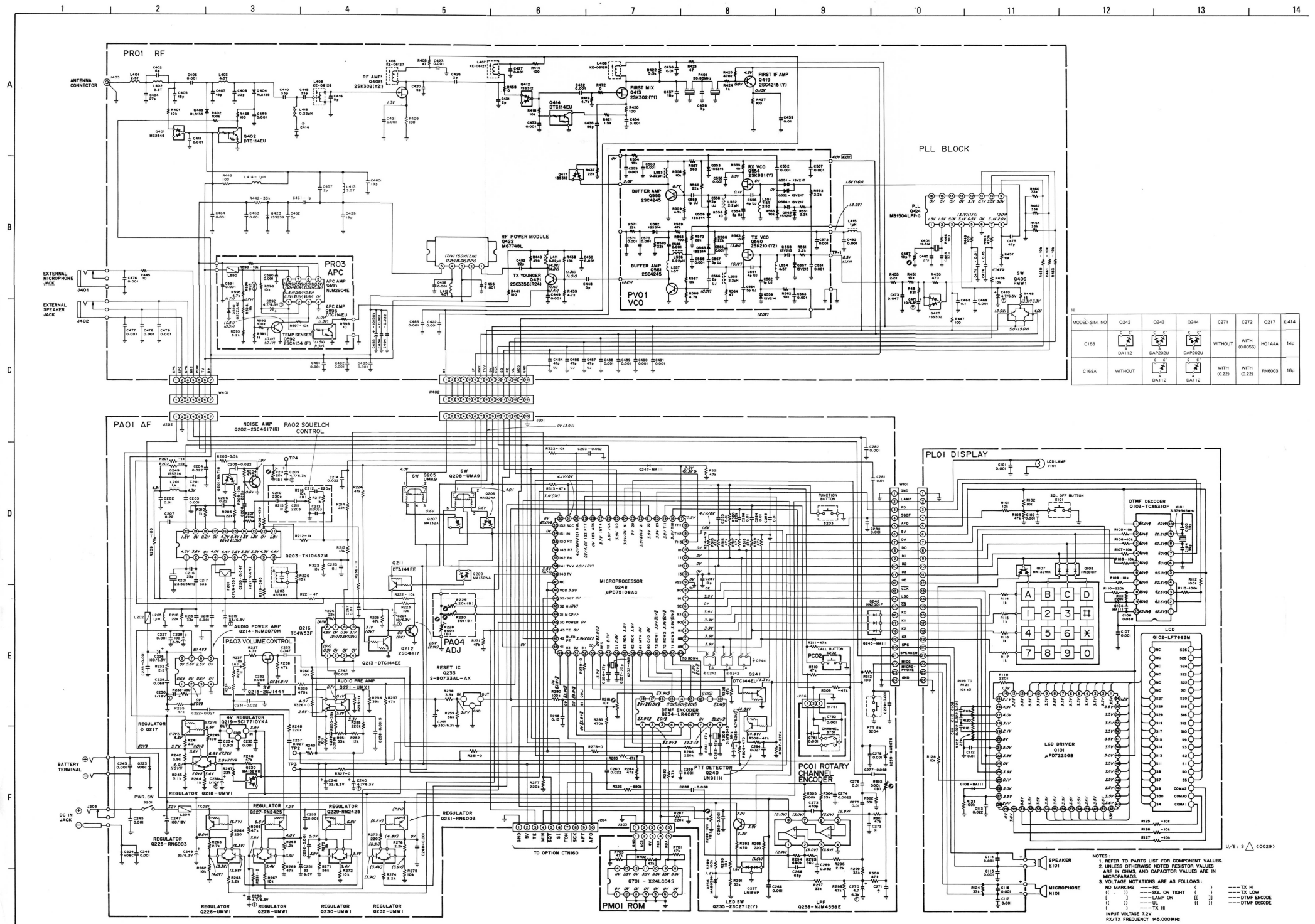
< 0003 >



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# 8. SCHEMATIC DIAGRAM



# 9. COMPONENT OVERLAY

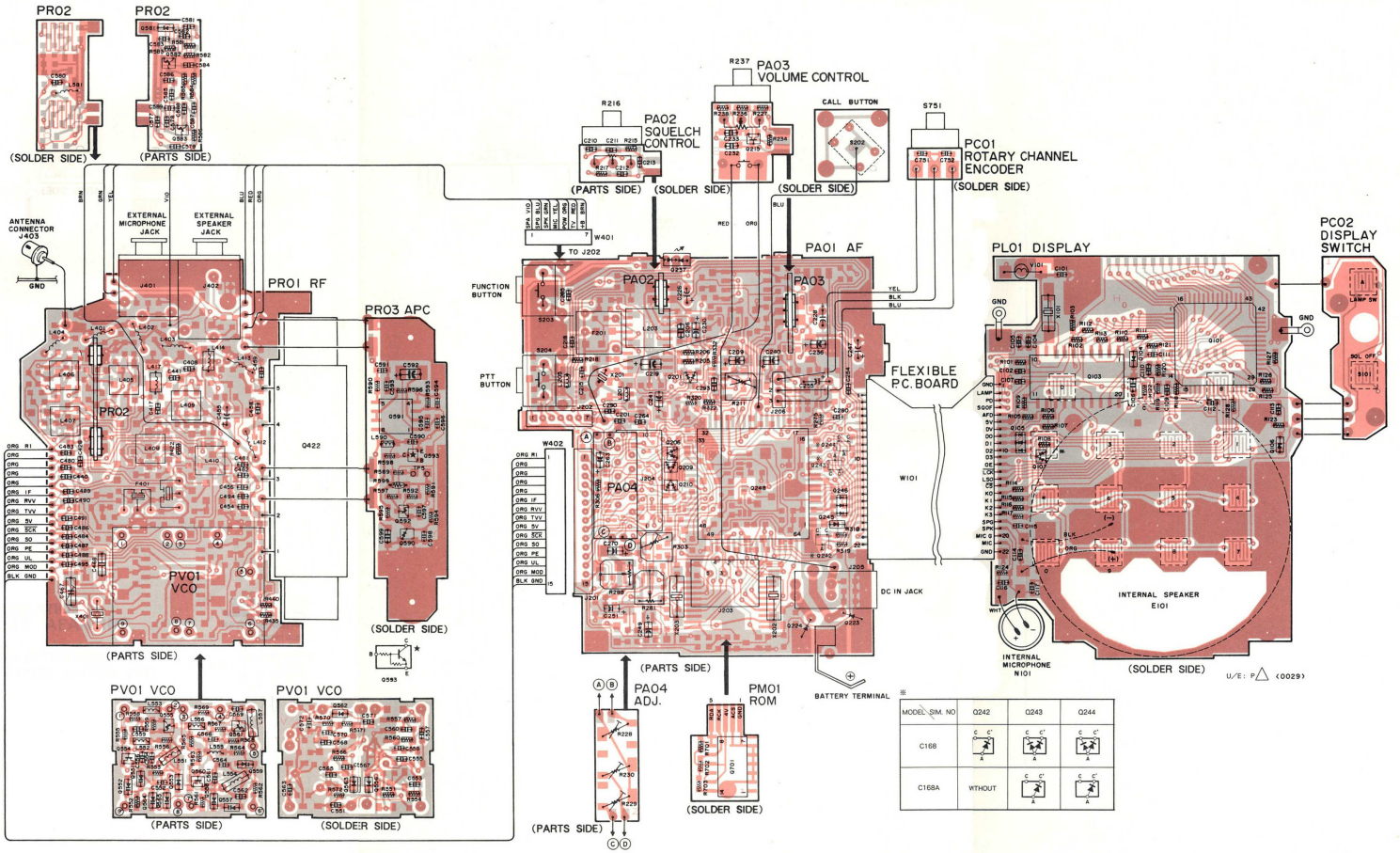
1 2 3 4 5 6 7 8 9 10 11 12

A

B

C

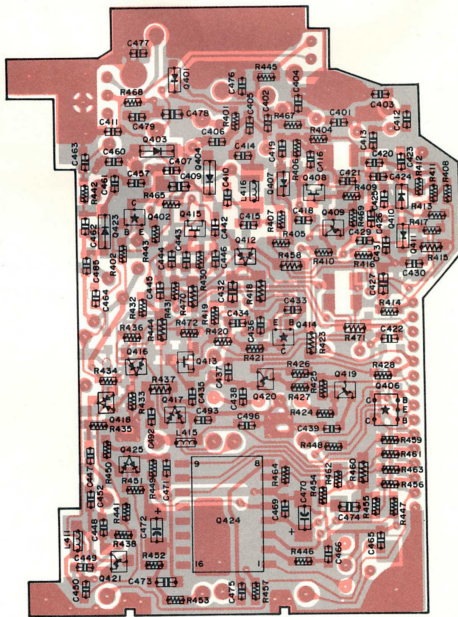
D



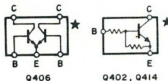
MODEL	SIM. NO.	Q242	Q243	Q244
C16B				
C16BA	WITHOUT			

U/E: P/A (0029)

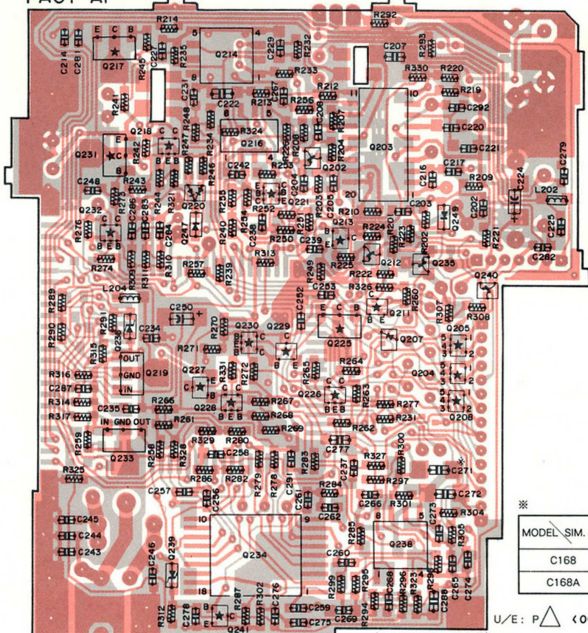
PRO1 RF



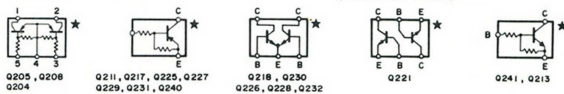
(SOLDER SIDE)



PA01 AF



(SOLDER SIDE)



※

MODEL	SIM. NO	C271
C168	WITHOUT	
C168A	WITH	

U/E: △ (0029)

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